# Electrical World

MARCH 21, 1942

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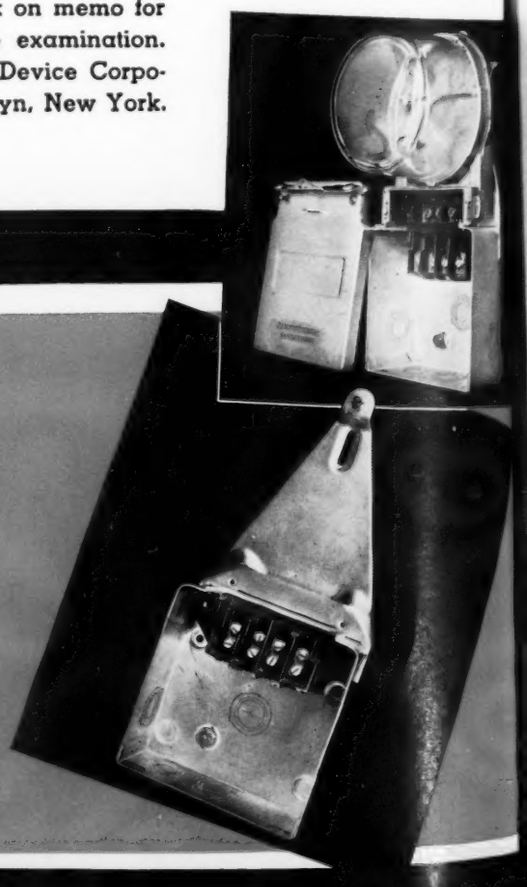

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# Electrical World

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March 21, 1942

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McGRAW-HILL PUBLISHING COMPANY, INC.
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Electrical World—Published weekly. Price 25 cents a copy. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, 330 West 42d Street, New York, N. Y. Subscription rates: In the United States, Mexico, Central and South American countries, $5 a year, $8 for two years, $10 for three years. Canada, $5.50 for one year, $9 for two years, $11 for three years (Canadian money at par). Great Britain and British possessions, 54 shillings for one year, 108 shillings for three years. All other countries $9 for one year, $18 for three years. Entered as second-class matter November 16, 1936, at Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. A. Contents copyrighted, 1942, by McGraw-Hill Publishing Company, Inc. Branch Offices: 520 North Michigan Avenue, Chicago; 68 Post Street, San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington, Philadelphia, Cleveland, Detroit, St. Louis, Boston, Atlanta, Ga.

Publication Office
99-129 North Broadway, Albany, N. Y.

Editorial and Executive Offices
330 West 42d Street, New York, N. Y.

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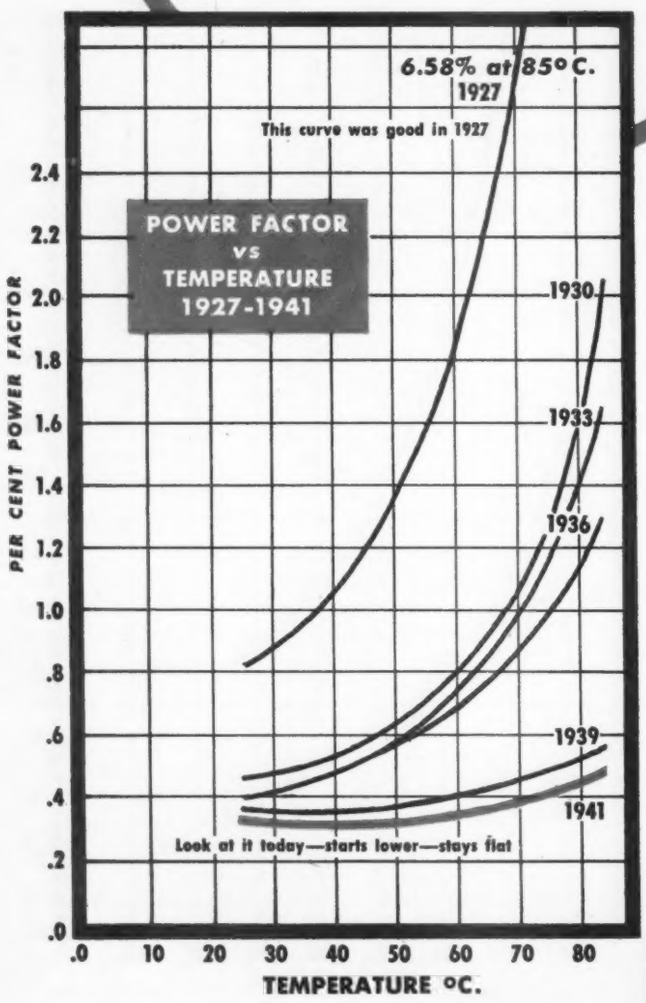
# OKONITE-CALLENDER RESEARCH

## LOOK

### at this LOW POWER FACTOR of OKONITE-CALLENDER PAPER INSULATED CABLES —it's One Example of the Progress Made




DOWN . . . DOWN . DOWN goes the power factor of paper insulated cables through Okonite-Callender Research. These curves are based on routine factory test results obtained on our production for each of the years indicated. Such improvement is typical of the way Okonite-Callender has stepped up the over-all efficiency of its paper insulated cables.

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**OKONITE-CALLENDER PAPER INSULATED CABLES**

# The Council

Last fall some utility operating companies, not very many, but enough, had the belief that utility men could get behind a leader and cooperate on at least one matter of public policy. And so in a modest way an advertising campaign to bring the industry's story to the public was launched.

The start of that campaign might almost be called ground hog day for the utility industry.

Hardly had the first advertisement appeared before a small group met in Philadelphia—December 17, to be exact, but ten days after Pearl Harbor—to suggest another cooperative effort in public policy. From this small meeting in Philadelphia there has evolved the Council of Electric Operating Companies, pledged to assist the government in every possible way in the war effort. Not only to do the things that the war agencies ask of it, but also on its own initiative to seek out ways wherein the industry can be of assistance to the nation is its aim.

There will be some who feel that the council should wage two wars, not only the war against the Axis foes but the war between public and private ownership as well. The members of this new organization are not unmindful of the attacks from within government against private ownership and operation of electric utilities. They feel, however, that it is impossible to engage in a protective alliance in the political arena and at the same time expect confidence on the part of the government that the organization is trying wholeheartedly to cooperate in waging the war.

This is the resolution of the council, and come what may, it must be carried out with all the intent and faith that the resolution implies. There must be no evasion, however small, so long as the announced policy stands on the record.

Undoubtedly there will be times when the industry will be sorely tried by acts of unfriendly agencies, but it will be of more importance for the industry to demonstrate its good faith and thus rewin public confidence. But of perhaps even greater importance will be the recapture of faith in itself. This is going to be a test. Can the industry find common grounds of agreement? Can it work together? Can it have leaders that will be respected within and without? And once it has given a committee authority to act for it, will it support fully and earnestly that committee? In other words, will the industry act as a unit and not as a group of individualists?

The council has given to a man and to a committee a great responsibility, but the responsibility for success rests equally well with the giver as the acceptor. No man or group of men can operate in all the hurly-burly of Washington in war-time without making some mistakes. We feel certain, however, that they will be honest mistakes that come from trying to do something constructive and should be the occasion only for constructive criticism.

There are now and will be many things that a united electric utility industry can do to help in winning the war. The extent to which they are well done will be the measure of the right of the industry to expect renewed public confidence in its operations. The lesson of interdependability, of working together as an industry, will be worth more than anything else. For out of them will come renewed strength, unity of purpose, leadership and a public policy that will be its strongest protection against any onslaught that may come after the nation is again at peace.

# Grand Coulee Firms Columbia River Hydro

***Largest structure ever built is 10,500,000-cubic yard dam to develop 1,944,000 kilowatts and irrigate more than a million acres in state of Washington***

*IREAL A. WINTER* and SIDNEY M. DENTON,† Bureau of Reclamation, Denver*

MAN'S largest structure, the Grand Coulee Dam, with its 10,500,000 cu.yd. of concrete, will impound, out of the average 109,000 sec.-ft. of Columbia River flow, some 5,165,000 acre-ft. of live storage to support a firm capacity of 925,000 kw. Average flow to maintain this output varies from 36,000 sec.-ft. with reservoir at 1,288 ft. elevation to 50,000 sec.-ft. with reservoir at the dead-storage level of 1,208 ft. Water required for the ultimate irrigation development is estimated to be 5,300,000 acre-ft. per year. After all irrigation requirements have been fulfilled the annual energy available is 10,800,000,000 kw.-hr.

### *Two Generating Plants*

Fully to develop the stream flow, the power installations will be in two plants, one at each end of the 1,000,000 sec.-ft. spillway. The left plant will ultimately comprise nine main units of 108,000 kw. each and three 10,000-kw. station service units. No station service units will be provided in the right plant, also to comprise nine main units of 108,000 kw. each. One 108,000-kw. and two of the station service units are operating, two 108,000-kw. units are being installed and six more are under contract.

Magnitude of the power development dictated the selection of the largest turbines and generators which it is physically possible and feasible to build. Turbines are rated 150,000 hp., 120 r.p.m., rated head 330 ft.

Unit spacing conforms to optimum stages followed in dam construction. Penstock sizes capitalize on approved methods of shop fabrication and field erection by electric-arc welding. Penstock valve sizes are largest feasible within limits of manufacturer's tools and of transportation facilities. Turbine runner is $16\frac{2}{3}$ ft. in diameter and weighs 70 tons. It will be shipped in one piece.

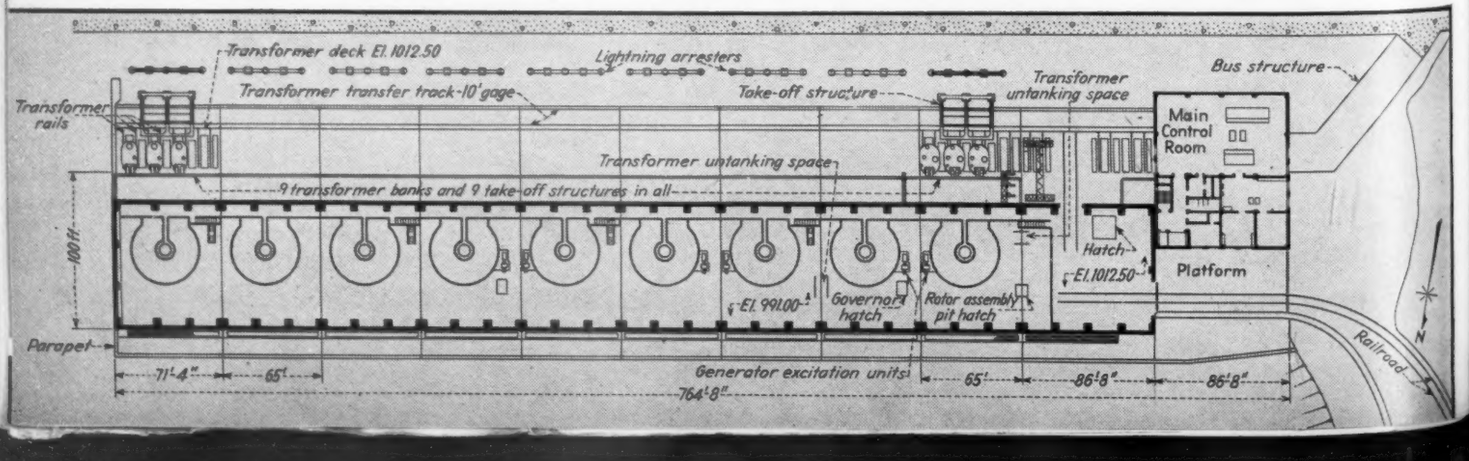
Irrigation water will be pumped by off-peak power applied to twelve 65,000-hp. pumps delivering 1,600 c.f.s. against a static head of 282 ft. to a 1,145,000-acre-ft. reservoir. Storage will supply the irrigation demands from November to March without pumping. These unprecedentedly large pumps are turbine type with fixed stay vanes in the pump casings; they will be operated in pairs served by one main generator.

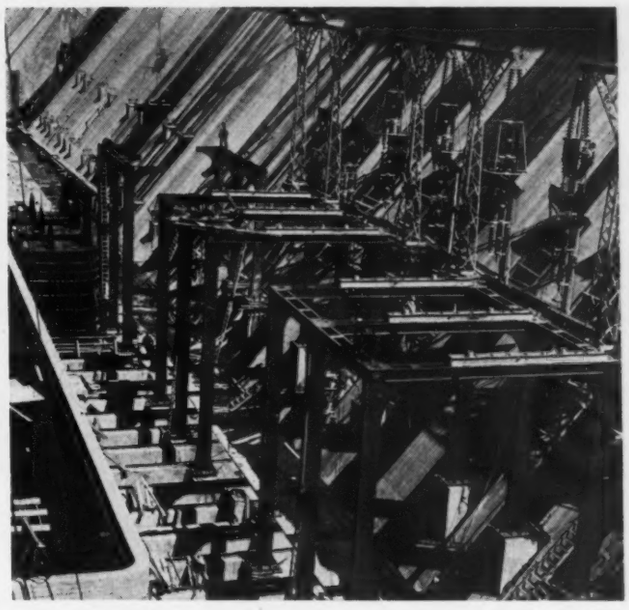
### *Generator Data*

Each 108,000-kva. turbo-generator has a flywheel effect of 175,000,000 lb. at 1 ft. radius. In conjunction with a short-circuit ratio of approximately 1.90, the machines provide sufficient charging capacity and stability to enable a single generator to energize a 250-mile, 220-kv. line and, further, to maintain synchronism through a double line-to-ground fault at the end of the line if it cleared in not more than 0.013 second. Each main generator has a direct-axis unsaturated transient reactance of about 25 percent and has amortisseur windings of low resistance.

Failure of insulation between turns can be detected by means of relays served by current transformers installed in the divided neutral leads brought out from each phase. A simi-

**ULTIMATELY nine 108,000-kw. generators in each of two plants at North dam, one at each end; only the West plant has been built**





**POWER DISTRIBUTION CABLES are run in conduit. Control cables generally supported on racks run in galleries (left). Transformers and switches on open deck against face of dam. Lightning arresters on pedestals. Steel structures support disconnecting switches, also the switches for applying de-icing energy from a house turbine (right).**

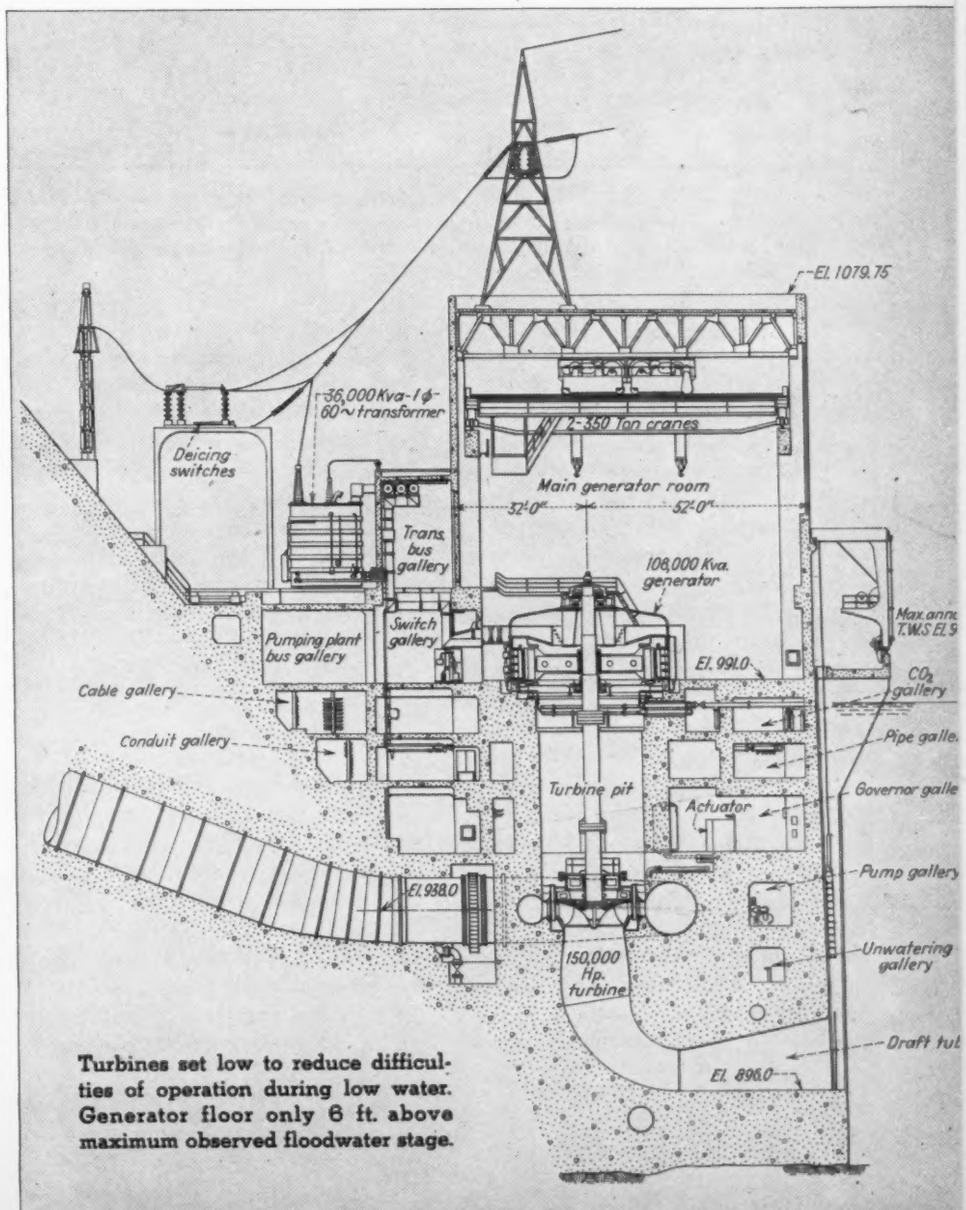
lar differential current relay in each combined neutral lead detects failure between phases. A potential transformer connected between generator neutral and ground operates an alarm upon occurrence of a single line-to-ground fault.

Separate synchronous-motor-driven exciters are provided for the first six generators so that they may have full excitation at zero speed when any of them is used to bring up to speed with it a pair of 65,000-hp. pump motors. The twelve other main generators will have direct-connected exciters. Each exciter is 400 kw., 250 volts and driven by a 600-hp., 6.6-kv. synchronous motor at 1.0 pf.

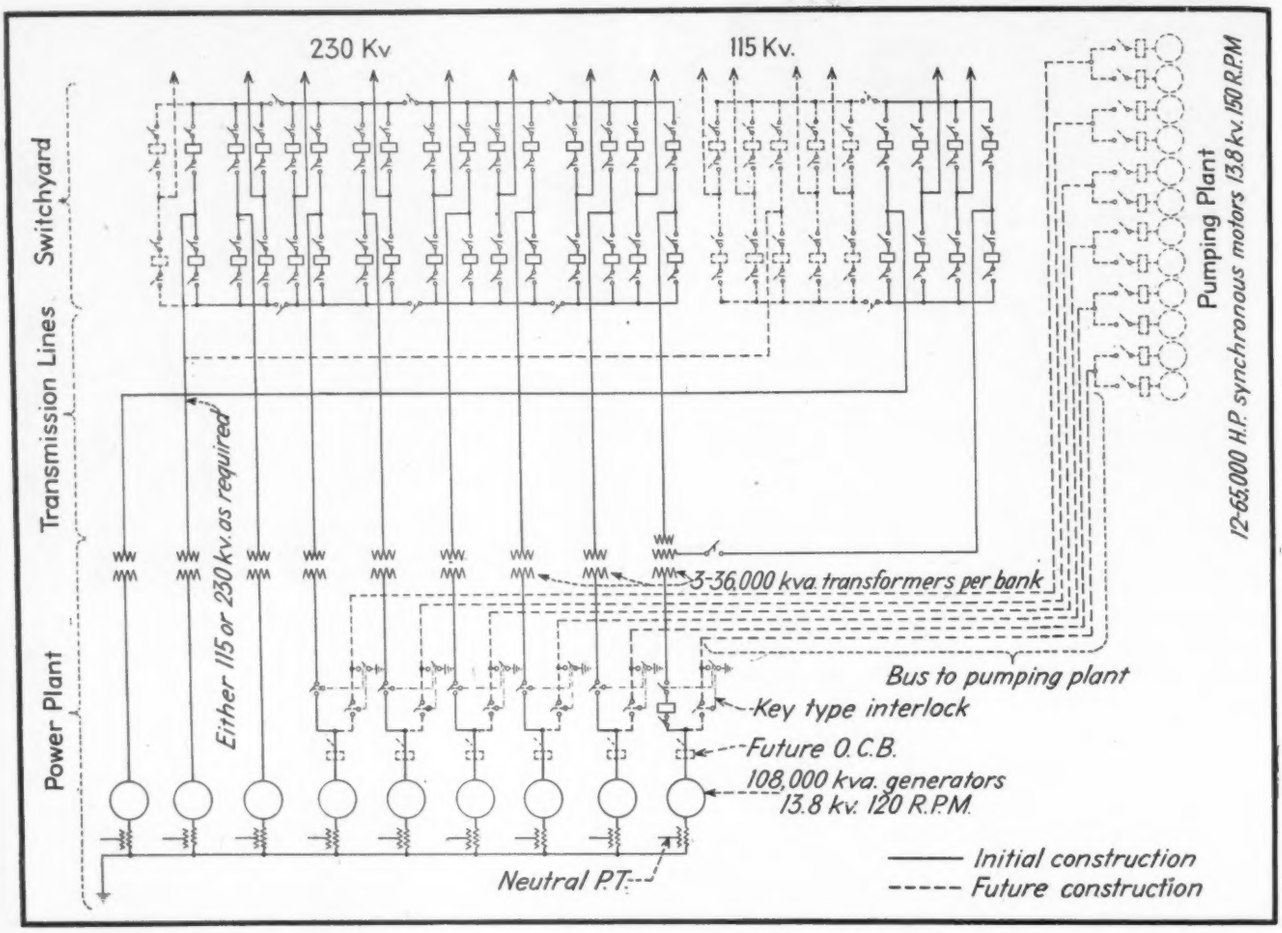
Exciter motors have 250 percent pull-out torque and 120 percent pull-in torque at normal voltage to avert loss of excitation during momentary dips preceding clearance of branch circuit faults.

### *Equipment Protection*

Each generator is protected against fire by means of carbon dioxide gas under thermostatic control. The installation is of sufficient capacity to reduce the combustion content of gases within the generator inclosure below 66 percent with the output of the initial group of cylinders. In case of a fire, spontaneous reignition is prevented by manual release of addi-




**Turbines set low to reduce difficulties of operation during low water. Generator floor only 6 ft. above maximum observed floodwater stage.**




**A HIGH-VOLTAGE SWITCHYARD will be located at each end of the dam. The present (left) switchyard is ½ mile from the present power house. The 230-kv. yard is divided into four sections by disconnect switches. The 115-kv. yard will be fed from unit L9 with standby provided by a three-winding transformer bank from the L1 unit**

tional cylinders to maintain a 25 percent $CO_2$ concentration for two hours, during which the heated parts will cool.

Six 1½-in. spray nozzles, each discharging 55 g.p.m. at 65 psi., protect the 36,000-kva. transformers. Installations are designed principally to lower the oil temperature below the combustion point and not to create fog to extinguish fire by steam generation.

No circuit breakers or rheostats are provided for the main generator field circuits. Circuit breakers are provided, however, to open the exciter field circuits automatically upon operation of the generator relays.

Each unit board which supplies the auxiliaries essential to greater operation is equipped with an automatic contactor which transfers the load to an emergency feeder served by the duplicate transformer bank in case of normal-circuit failure.

Isolated phase construction is employed for the 5,000-amp. connections between the generators and the 36,000-kva., single-phase, oil-immersed, water-cooled, nitrogen-filled transformers on the deck between the upstream wall of the power house and the face of the dam. The connections consist of tubular copper inclosed in a circular copper housing, thus providing two walls of metal and three air spaces between conductors. High-side neutrals are grounded solidly or through ground-fault neutralizers.

### *Switching and Relaying*

Both the 230-kv. and 115-kv. switchyards are arranged for complete double-bus switching. All 115-kv. oil circuit breakers have 8-cycle operation and are rated at 1,200 amp. and 2,500,000 kva. interrupting capacity. The 230-kv. oil circuit breakers have like ratings; line breakers operate in 3 cycles and generator breakers in 8 cycles. In order to place a reasonable limitation on interrupting duty imposed on oil circuit breakers, not more than three generating units will be connected to the same bus at any time.

In case of generator trouble the differential relays not only de-energize the circuit involved but also close the turbine gates to stop the unit and release the carbon dioxide into the generator housing. Transmission-line relays are of the distance type with carrier-current pilot control.

Each power house and each high-voltage switching station has a storage battery to serve the control and relay systems. Connections to the equipments from the batteries are large current-carrying capacity bus systems. Circuits to the control stations for each major piece of equipment are energized at the equipment in such manner as to permit ready de-energizing of the entire operating and control system for each equipment when it is taken out of service.

# Improved Theater Lighting Layout

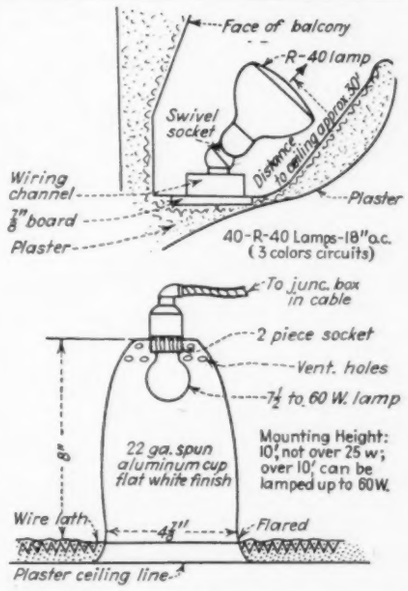
***Fluorescent lobby lighting combined with concealed incandescent down-lighting, down-lighted foyer and cove-lighted lounge feature theater lighting plan***

***FREDERICK M. HILL, Electrical Engineer, New Haven, Conn.***

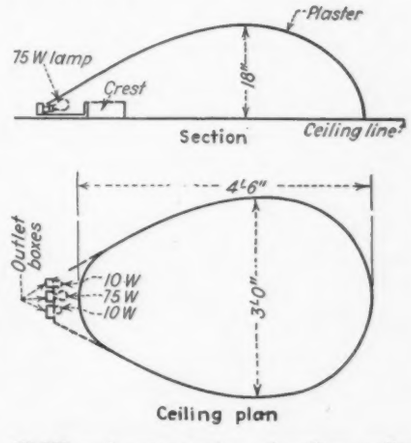
IN DESIGNING the lighting facilities of the Whitney Theater, Hamden, Conn., the first requirement was to make these an integral part of the theater, providing close co-ordination with such features as acoustical forms, contouring, the air-conditioning system and interior color schemes. First cost, operating cost, accessibility and flexibility also entered the picture. Psychological factors were considered in directional lighting and color tones, all light sources being carefully concealed and "hot spots" of any kind avoided.

To meet these requirements three types of lighting were provided: (1) Direct down-lighting from concealed sources in the marquee and entrance areas; (2) entrance lobby with fluorescent and neon tube lighting from concealed sources, with a Wagner neon tube attraction sign; (3) a foyer down-lighted in a similar manner to the outer lobby, and a cove-lighted lounge.

The auditorium main front ceiling is entirely lighted from a cove on the balcony front. New "R-40" and "PAR-38" lamps, being efficient projection units, are mounted on swivel sockets and directed to spray on the ceiling. By trials it was found that an area of 6,000 sq.ft. could be satisfactorily illuminated with 3,000 watts of white light, giving 10 ft.candles on the floor with a ceiling reflection factor of about 40 percent. The ceiling was painted light gray to blend with the side walls, which were covered with a rich paper of warm tone. Twenty white 150-watt lamps were used, and for color circuits ten 300-watt for blue and ten 150-watt units for red, all on dimmer controls. A flat white ceiling would have been better from the standpoint of efficient illumination, but because of screen light reflection it would not have worked out well. The white lighting was shaded with magenta and light amber filters to a proper color tone.




**METHOD of mounting cove and recessed lighting units**




**PLAN and cross-section of ceiling coffer lighting**

For the standee area under the balcony a new type of ceiling coffer was designed. These coffers consist of egg-shaped cavities about 4 ft. 6 in. in length and 3 ft. in diameter, with a vertical section one-half the full opening shape. Five outlets were provided at the pointed end of this oval, using one 100-watt unit on the emergency circuit, two 50-watt lamps for house lights and two 7.5-watt lamps for low-intensity lighting during film presentations. These proved simple to lamp and very effective and attractive in appearance, as well as low in wiring cost, since no cove was required—merely a shelf-like recess in the extended point of the oval. Although the wiring cost was negligible, the construction of this shape was more expensive, since templates had to be carefully made by the wire lath contractor. However, while the total erection cost of this shape is about equal to that of a circular cove, the operating and lamp cost is negligible.

### *Ceiling Lighting*

The tone or color of the general ceiling lighting is in tints rather than in prime colors and these colors can easily be changed by using snap-on color filters of the "Lorelei" type, obtainable in pastel shades such as pink, magentas and light ambers.

The air-conditioning control wiring has numerous safety devices, including a thermostatic duct switch which cuts off all air supply when the duct temperature rises above the set safety point. Similarly, an emergency switch in the projection room is operated by the drop shutters, which, as well as stopping the air supply, automatically turn on the emergency or "panic" lights. These consist of three 500-watt flush-lowered Alzak reflectors, set just ahead of the ceiling breaks and can also be used, by additional switch, for cleaning service, avoiding use of the main house lights for this purpose. The Jem Electric Company was the electrical contractor. There are about 1,000 seats and the complete electrical cost, including lamps, air-conditioning wiring and control wiring for 75-hp., projection and sound wiring, marquee and sign wiring (including 5 stores), was about $10,000.

# Quicker Way of Computing Distribution Short Circuits

*New combination of charts, template and table shortens the process of calculating overcurrent protections in series for long-line fault clearance*

*JOHN D. SAUTER, West Penn Power Company and G. F. LINCKS, General Electric Company*

KNOWLEDGE of the short-circuit current at various points on a distribution system is required for the proper selection of overcurrent protective devices connected in series on long lines. Distribution lines have expanded far into rural areas, in some cases a hundred distribution circuit-miles served by a single substation. With circuits of this length, it is not possible to set a breaker to control the distant points and still carry the full load of the circuit. It is therefore necessary to use overcurrent protective devices out on the line in order that faults which are too small to operate the breaker may be cleared from the line.

Service continuity is of real importance if load building is to progress so as to make these lines economically practical. Use of sectionalizing and branch-line fusing will automatically confine the effect of overcurrent faults to only a few consumers and thus make possible a major improvement in service continuity over that which can be provided by the most efficient substation equipment alone on urban and suburban systems as well as on rural circuits.

Accurate data are available on relays, fuse links, reclosing cutouts, reclosing line oil switches and other sectionalizing equipment. With these data it is easy to coordinate these devices when used on distribution circuits so the proper device will operate without any effect on the other devices, provided the maximum and minimum fault currents are known over the entire circuit.

In order to coordinate these devices, the utility engineer is confronted with the task of calculating these short-circuit currents point by point along the circuit, starting at the substation with a known short-circuit capacity and then progressing to the ends of all branches. Often this job is made too laborious by using complex mathematical calculation to secure unnecessary exactitude. An error of several percent in distribution short-circuit current calculations need not be considered excessive, as much of the data necessary for making these calculations are not known accurately.

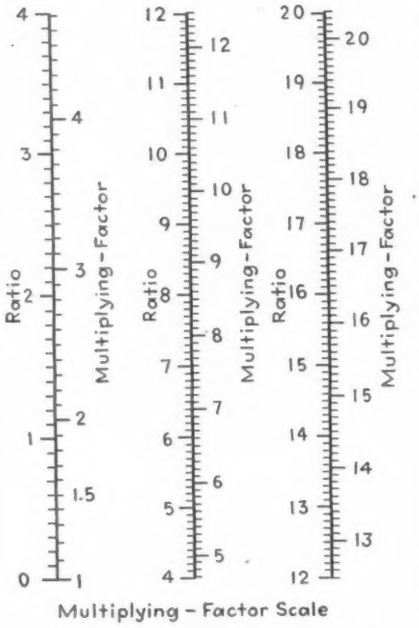



**FIG. 1.—Multiplying factors based on vectorial calculations are the average values for overhead conductors on 60-cycle systems sizes No. 6 to No. 4/0 inclusive.**

The ratio is found by dividing either the equivalent length of line (one way) having the same impedance as the system from the generator to the substation secondary bus (see Fig. 2) by the length of line (one way) from the substation to the point under consideration on the distribution circuit or *vice versa*. Read multiplying factor directly from above chart. Multiply the divisor by the factor, to obtain the equivalent length of line from the generator to the point under consideration on the distribution circuit.

### *System Impedance*

In actual practice the generator, transmission lines and substation impedances are seldom so small in relation to the distribution line impedance that they can be neglected. This means that the bus has a definite short-circuit capacity which is usually known or can be calculated with reasonable accuracy from the substation transformer impedance—neglecting that of the generator and transmission lines. This impedance is treated entirely as reactance (because the resistance is usually negligible) and must be added vectorially to the impedance of the distribution line.

A simplified method for calculating these short-circuit currents, using nomograms, has been in use for a number of years.[1, 2] The factors employed in these calculations are the length of line, the conductor size and spacing, the volts and the bus short-circuit amperes or substation transformer rating and impedance. This

[1] "Calculations for Distribution Faults," by G. F. Lincks and H. G. Brinton, "Electrical World," February 1, 1936.

[2] "Fuse Coordination Studies Now Easy," by G. F. Lincks, *Distribution*, July, 1940.

**Table I**

| Equiv. Bus Length "A" | Circuit Length "B" | Ratio A — B | Multiplying Factors from Fig. 1 | Short-Circuit Current with Sustained Bus Voltage from "A" | Actual Short-Circuit Current Curve "E" |
|---|---|---|---|---|---|
| 10 | 1 | 10 | 10.52 | 10,000 | 950 |
| 10 | 5 | 2 | 2.82 | 2,000 | 710 |
| 10 | 10 | 1 | 1.86 | 1,000 | 540 |
| 10 | 30 | 0.33 | 1.27 | 333 | 262 |
| 10 | 100 | 0.10 | 1.08 | 100 | 92.5 |
| 10 | 300 | 0.033 | 1.03 | 33.3 | 32.4 |
| 10 | 1,000 | 0.01 | 1.01 | 10.0 | 9.9 |

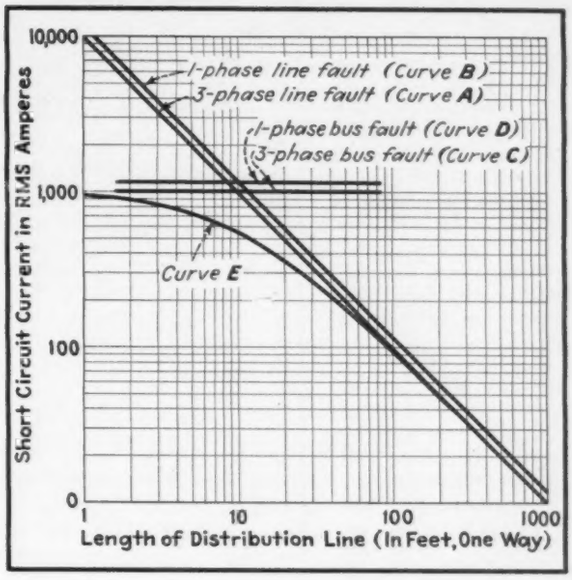
method employs a chart (Fig. 1) which makes possible the quick vectorial addition of the reactance of the generator, transmission lines and substation transformer to the impedance of the distribution line beyond the bus. However, this vectorial addition has to be performed separately for each point under consideration, and thus represents a high percentage of the time and effort required for the total calculations.

***Development of Curve and Template***

This chart was the basis for the development of a new method which performs the vectorial addition automatically. Using the same system data as for the older method, this new one permits reading the short circuit at any point on the line directly from a curve drawn by a template. Checking probable variations indicates that the values taken from the curve will be within 0.5 of 1 percent to 6 percent of the short-circuit currents found by mathematical calculations of identical problems.

With rated voltage sustained at the substation bus, the values of short-circuit current on a distribution system of one wire size and spacing varies inversely as the distance from the substation. A straight line results when the short-circuited current ($X$) and the length of line ($Y$) (a hyperbolic function $X \times Y = K$) are plotted on log log coordinate paper such as curve (A) and must be added vectorially to the length of distribution line in order to obtain the total equivalent length from the generator to the point on the line under consideration. From several of these total equivalent lengths a new curve (curve E, Fig. 2) can be plotted, from which can be read directly the short-circuit currents as limited by the impedance from the generator to the point where the fault occurs. The method of plotting both the three- and single-phase curves is explained under Fig. 2.

All the curves shown in Fig. 2 will always have the same physical relation to each other for a given log log paper even though the numerical values of the ordinates and abscissae are changed. Therefore, these curves can be made into a template (Fig. 3) which can be moved over the log log




1. Assume a three-phase distribution line having a size and spacing of conductor and a sustained voltage such that one foot will limit the three-phase symmetrical short-circuit current to 10,000 amp. Then 1,000 ft. will limit the current to 10 amp. Draw curve "A" through these two points with current as the ordinate and length of distribution line (one way) as abscissa. It will be a straight line having a 45-deg. slope.

2. Draw curve "B" so that the ordinates will be 1.15 times the ordinates of curve "A." This curve will be used to find single-phase short-circuit currents as explained under Fig. 4.

Curves A and B can be used for any size and spacing of conductor, any voltage or any length simply by changing the numerical values of the ordinates and abscissa. Conversely the curves can be moved, keeping the same slope (45 deg.), on the log log paper until they intersect the numerical values for the actual short-circuit current and length of line.

3. Assume a three-phase bus short-circuit current of 1,000 amp. Draw a horizontal line curve C, intersecting curve A at 1,000 amp. and 10 ft. Impedance of the system from bus to generator is thus equivalent to 10 ft. of distribution line. This line can be moved with reference to curve A to correspond to any bus short-circuit current.

4. Draw a horizontal line D at 1,150 amp. (1,000 × 1.15). This line will be used to find single-phase short-circuit currents as explained under Fig. 4.

5. Curve E must be drawn so as to give the actual three-phase short-circuit current for various lengths of distribution line from the substation (one way) for the above assumptions, as limited by the total impedance from the generator to this point on the line under consideration.

In drawing curve E the short-circuit currents for sustained voltage curve A will be reduced by the ratio:

$$\frac{\text{Distribution line length beyond substation}}{\text{Total equivalent line length from generator}}$$

or

$$\text{Distribution line length beyond substation} \times \text{Distribution line length beyond substation x multiplying factor (Fig. 1)}$$

which is the same as dividing the short-circuit current with a sustained bus voltage (curve A) by the multiplying factor. Table I gives the actual assumptions.

Curves A, B, C, D and E will always have the same physical relation to each other for a given log log paper even though the numerical value of the ordinates and the abscissa are changed.

Therefore, these curves in the form of a template can be moved together over the log log paper until the proper curves coincide with the curves representing the actual condition of voltage and conductor size, conductor spacing, number of phases and bus fault current.

**FIG. 2—Development of curves for calculating short-circuit currents.**

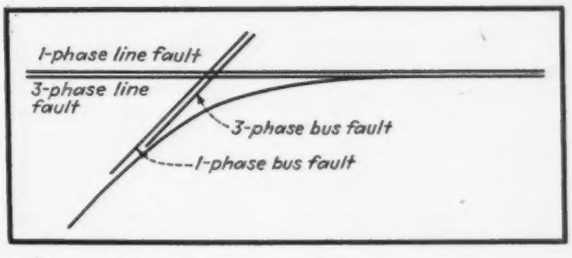



**FIG. 3 — Template made from curves plotted in Fig. 2. Curve E is the curved edge of the template so that curves can be easily drawn on a chart prepared for the circuit under consideration on identical log log paper to that used in drawing curves in Fig. 2.**

**Preparation of log log sheet:**

1. Assume a wire size and spacing as a base for all calculations, such as No. 2 wire with 30-in. spacing. Actual wire size and spacing can be converted into equivalent lengths of this case wire size and spacing by multiplying the actual lengths by the factors found from the curves in Fig. 5.

2. Assume values for ordinates and abscissa that fit actual conditions.

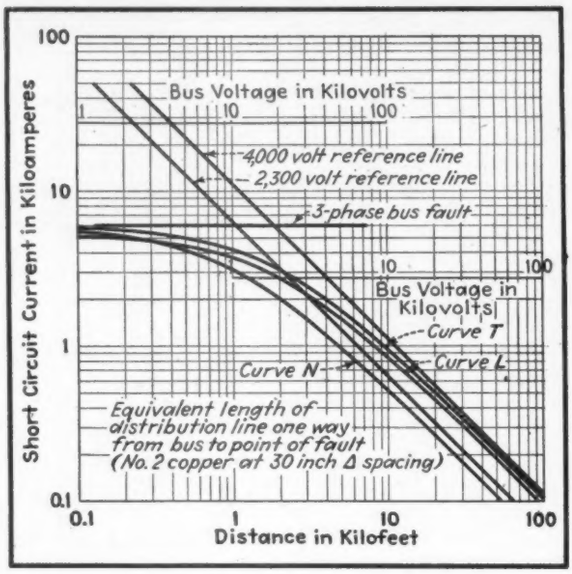
3. Draw the two horizontal lines marked "Bus voltage in kilovolts" at the calculated 1,000-volt, three-phase short-circuit currents for 100 ft. and 1,000 ft. of No. 2 conductors with 30-in. triangular spacing. These lines are horizontal because, for example, the short-circuit current at 1,000 ft. on a 1,000-volt circuit will be the same as at 4,000 ft. on a 4,000-volt circuit.

4. These two horizontal voltage lines permit drawing of "reference lines" (such as curve A, Fig. 2) quickly for systems of any voltage. Assume a 3-phase Y-connected circuit having a bus voltage of 2,300/4,000 volts and a 3-phase short-circuit capacity of 6,000 amp. Draw the two reference lines through the actual voltage points on the two lines marked "Bus voltage in kilovolts."

The "4,000-volt reference line" gives the 3-phase symmetrical short-circuit current for various lengths of No. 2 conductor with 30-in. triangular spacing assuming sustained bus voltage. The "2,300-volt reference line" gives similar data for a 2,300-volt, 3-phase circuit and is used to find the line to neutral short-circuit currents as explained later.

5. Draw a horizontal line through the reference lines at the 3-phase bus short-circuit current. If only the single-phase line to line current is known multiply this by 1.15 (this equals $2\sqrt{3}$). It is assumed that the single-phase line to neutral currents at the bus are the same as the 3-phase short-circuit currents.

The sheet is now ready for the use of the template shown in Fig. 3.




**How to Use Template**

*Three-phase short-circuit currents:*

Place the lines marked "3-phase line fault" and "3-phase bus fault" on the template so that they coincide with the "4,000-volt reference line" and the "3-phase bus fault" on the log log sheet. Draw the curve from the curved portion of the template. This curve "T" will give the 3-phase symmetrical short-circuit at any point on the distribution circuit as measured one way from the substation bus.

*Single-phase line to line short-circuit currents:*

Place the lines marked "1-phase line fault" and "1-phase bus fault" on the template so that they coincide with the "4,000-volt reference line" and the "3-phase bus fault" on the log log sheet. Draw the curve from the template. This curve "L" will give the single-phase line to line short-circuit current for any point on the circuit. (The current values from this curve will be the values from the 3-phase curve "T" divided by 1.15.)

*Single-phase line to neutral short-circuit currents:*

Place the lines marked "1-phase line fault" and "3-phase bus fault" on the template so that they coincide with the "2,300-volt reference line" and the "3-phase bus fault." Draw the curve from template. This curve "N" will give the single-phase line to neutral short-circuit current for any point on the circuit. (The current value from this curve will approach the "3-phase bus short-circuit current" at points near the substation and approach one-half the 3-phase short-circuit current of line at points out on line where the line impedance predominates over the bus impedance.)

**Fig. 4—Chart for direct reading of short-circuit current at any point of a distribution circuit.**

paper until the lines on the template coincide with lines previously drawn for any combination of the bus fault current and for the distribution circuit fault current as explained later. Direct reading curve (E) can then be drawn. The distances are usually given in length of line one way, but represent the impedance of the total length both ways.

### *Application*

The log log sheet must be prepared with proper numerical ordinates and abscissas, assuming one wire size and one wire spacing as a base (to which all other sizes and spacings are to be converted using the multiplying factors from Fig. 5) and drawing horizontal lines of bus voltages as explained in Fig. 4. Sheets having this information can be prepared in quantities for future use.

For a particular problem, the lines for short-circuit current are drawn through the values of the bus voltages and are called "reference lines" in Fig. 4. Next a horizontal line is drawn for the three-phase bus short-circuit current. Then, using the template as explained under Fig. 4, curves for the actual short-circuit current can be quickly drawn.

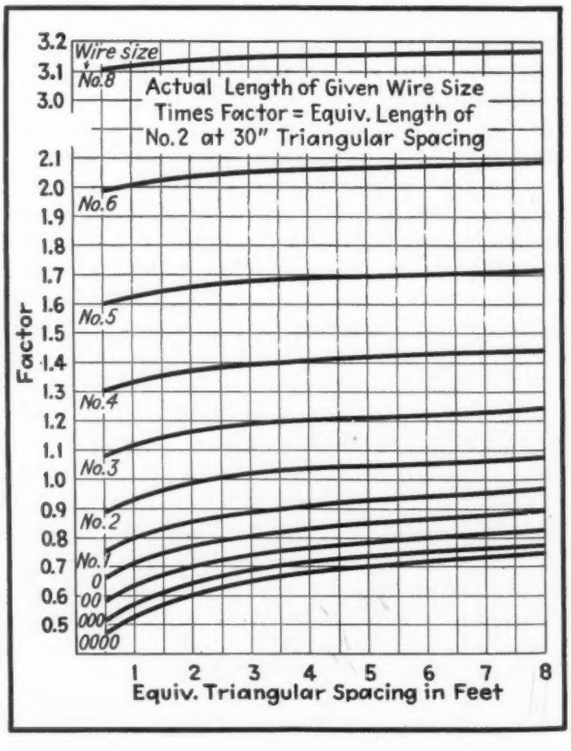



**FIG. 5—Curves providing a multiplying factor for converting the length of any wire size to the equivalent length of No. 2 conductor and 30-in. triangular spacing for 3-phase or flat spacing for single phase which has been arbitrarily chosen as base**

# PLOUGHSHARES INTO SWORDS

*Maximum production of war goods and most efficient production of essential civilian goods are the prime objectives of American industry today. Profit, business advantage, concern for market, all normal peace-time considerations, are of secondary importance. The quicker and the more thoroughly this conception of the industrial function is accepted, the sooner it will be possible for American manufacturers to return to the ways of peace.*

*The war-time objectives of industry are having large effect on the responsibilities and the problems of the electric utility in industrial power supply and thus also on the job of the power salesman. A new element is added to his job, the normal functions of which at the same time are intensified in importance and urgency. Today the power salesman's job is bigger and more important than ever and included in it is a heavy obligation of service to his country.*

*The new element is conversion of industry, particularly of the thousands of small plants scattered up and down the nation and which are roughly one-half of all American industry, from production of peace goods to the making of tools and materials of war. Many agencies of government and of business are hard at work effecting this conversion. The electric utilities have joined in these efforts and their usefulness in them has already been amply proven.*

*To help bring that usefulness to its maximum, to make available to all electric utilities knowledge of what others are doing, and thus to increase general effectiveness,* Electrical World *presents in the following pages the results of a survey and study of utility activities in expediting industrial conversion.*

*No attempt is made to list and specify agencies at work on conversion, sources of information, goods wanted, examples of conversion or details of procedure. Such information is widely circulated and readily available to all interested. Instead, the purpose of this presentation is to show the immediate need for small plant conversion, to give some conception of its necessary extent and of its difficulties and to state what electric utilities can do by reciting what they are doing in this big task of beating ploughshares into swords.*

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Information on their activities in conversion of small industrial plants to war production were received from the following electric utilities. To them ELECTRICAL WORLD offers hearty thanks for prompt and interested cooperation.

Utah Power & Light Company
Central Vermont Public Service Corporation
Commonwealth Edison Company
Southern Colorado Power Company
Sierra Pacific Power Company
West Penn Power Company
Southern California Edison Company, Ltd.
Pacific Gas & Electric Company
Electric Power Board of Chattanooga
Northwestern Electric Company
Puget Sound Power & Light Company
Pacific Power & Light Company
Union Electric Company of Missouri
Consolidated Gas, Electric Light & Power Company of Baltimore
Georgia Power Company
Pennsylvania Electric Company
Pennsylvania Power Company
Indianapolis Power & Light Company
Wisconsin Power & Light Company
Lake Superior District Power Company
Des Moines Electric Light Company
Kansas City Power & Light Company
Consumers Power Company
Blackstone Valley Gas & Electric Company
The Toledo Edison Company
Rochester Gas and Electric Corporation
Florida Power Corporation
Southwestern Public Service Company
Tide Water Power Company
Texas Electric Service Company
Minnesota Power & Light Company
Buffalo Niagara & Eastern Power Corporation
Florida Power & Light Company
Public Service Electric & Gas Company
Public Service Company of Oklahoma
Oklahoma Gas & Electric Company
Nebraska Power Company
Jersey Central Power & Light Company
Public Service Company of Colorado
Portland General Electric Company
Idaho Power Company
Pennsylvania Power & Light Company
New Orleans Public Service, Inc.
The Washington Water Power Company
Central Hudson Gas & Electric Corp.
Sioux City Gas & Electric Company
Philadelphia Electric Company

# "Power Salesmen—Front and Center!"

*B. T. BONNOT, Contract Distribution Branch, War Production Board*

Out of 184,230 industrial plants in this country, 178,272 have fewer than 250 employees each. The aggregate proportions of these so-called small plants in the national industrial totals are: Over 48 percent of workers; over 43 percent of wages paid; over 47 percent of dollar volume of products. So says the U. S. Census of 1940. These small plants therefore represent practically one-half of American industry.

Immense quantities of ordnance, munitions and other war goods are being produced and much more will be produced in plants built or building for this especial purpose. But this is not enough. Whole industries are now being, and more will be, converted to war production. But this is not enough. There will not be enough until every industrial plant in the United States is producing war goods, every plant that is capable of doing so and is not fully engaged in production of essential civilian requirements. This will be enough only because no more will be possible.

### *Big, Bigger, Biggest*

It is a big job to plan and build great new factories to turn out the materials of war. That job is well in hand. It is a big job, too, to convert whole industries from civilian to war production. That job also is well in hand. But neither of these, nor both of them together, is so big a job as that of convincing over a hundred thousand owners and operators of small plants that their manufacturing facilities are urgently needed in war production and that they must use their own enterprise and skill to find the work they can do and to figure out how to do it. This biggest job has been started but it is not yet well in hand. To get it well in hand will require not only the best efforts of every interested government agency but of every other party concerned.

### *Wide and Intimate Contact*

Are the electric utilities a concerned party in the effort to convert small industry to war production? They are, for two reasons. One is that they have a breadth and intimacy of con tact with small industry that is unique. Their power salesmen know and are known to the small plant operators. In very many cases power salesmen have not only a knowledge of the machine and other facilities of the industrial plants in their areas but also a pretty keen appreciation of the abilities and disabilities of the men who manage and operate them. No other group is so well qualified as are utility power salesmen to seek out small industrials and to carry to them the message that they are needed in war production. This is the big reason why the electric utilities are a concerned party in conversion. The other reason is a directly selfish one from the utility standpoint. Maybe it should not be mentioned here. But every reason of patriotism is selfish at bottom, no matter how it is expressed. We are fighting for *our* country, for *our* homes, for the way *we* want to live. So let's be completely candid. The second reason why the electric utilities are a concerned party is that nearly every small industrial that does not survive the pressure of these times of war is a lost customer.

In their power sales organizations the electric utilities possess an exceptionally effective means for helping to convert to war production the small plant half of American industry. Also they have a very definite stake in the success of this conversion. How can they best perform the duty so plainly laid on them?

It is impossible for the War Production Board or any other arm of government to issue a practicable order to 178,000 manufacturers telling them that on a certain date they will cease established production and prepare forthwith to turn out war goods. Many of these manufacturers are making products essential to maintenance of the nation's civilian economy which, properly restricted, must continue. Many of them have neither the facilities nor the skill required for war production. And, since we do not live in a meticulously regimented society, the effect of such an order in many cases would be to arouse opposition that would act to prevent realization of the purpose of the order.

### *Widespread, Individualistic*

Because it was dealing with an industry highly integrated as to ownership, management, products and locations of plants the government could order the stoppage of automobile production and the immediate conversion of facilities to the making of planes, tanks and guns. But the 178,000 small manufacturers do not constitute a highly integrated industry in any sense. On the contrary, ownerships, managements, products and plant locations are diffused, scattered all over the country. And, characteristically, the owners and operators of these plants are generally conspicuous exponents of sturdy American individualism. If they were not they would not be those owners and operators. Even if it were possible to give them orders en masse, they probably would not stand for it.

It is plain, therefore, that to convince small industry of its duty and of its advantage in conversion to war goods production, practically every member of this industrial group must be sold individually.

**If you want reprints—**

**Copies of this study of the electric utility angles on industrial conversion are available at 10 cents each for quantities of ten or more. Fewer than ten will be supplied without charge.**

More than that, every one of them must be made to understand that getting into war production is not a matter of waiting for the government to come and buy from him, but of him going out selling to the government or to its prime contractors. In other words, the small manufacturer must be a self-starter in the business of producing and selling war goods, just as he was in supplying the domestic market. And although they may appear in somewhat different form, he must expect to encounter the same obstacles of competition and sales resistance with which he has always had to contend. Thus the conversion of small industry is a double-barrelled problem of immense size; one necessity is to reach over 100,000 manufacturers individually and the other is to get them steamed up to go after war business.

### *Wide Front Attack*

The problem can be licked only by decentralized attack on it. Realizing this, the War Production Board has established 116 branch offices over the country. These are in addition to the already numerous and widely scattered offices and sub-offices of Army, Navy and other government procurement. Exhibits showing products and bits and pieces that are needed extend the effectiveness of the decentralized approach. The WPB field offices were intended to be, and they are rapidly becoming, all-inclusive job clearing houses or official war work exchanges. To them prime contractors and major subcontractors report their current sub-contracting possibilities or needs.

Bulletins reporting such information are now being published in many areas.

All this is very good. Increasing results are being shown by these efforts. But the results have not yet been so good nor so many that help from any quarter is not heartily welcomed. Help is coming from trade associations, from chambers of commerce, from interested citizens and from many electric utilities. All this help is based upon the proposition that it is better to bring the work to the tools rather than the tools to the work.

Men work best at their accustomed machines, in their home towns and under familiar supervision. War goods production may cost a little more by scattering the work around among small plants, but so doing will achieve a quicker production flow and will avoid much dislocation of workers' lives and of community economies. We don't want any more dislocation of this sort than is absolutely necessary.

The function of the electric utilities and of their power salesmen in this picture is that of a vitally interested friend of small industry. Practically, the power salesman can, and should, be a "leg man" for his friend the manufacturer, bringing to him information on what and how much is needed of the things the manufacturer is making or can make. The power salesman has already been and will continue to be most helpful in surveying local production facilities, in listing machine tools and their capabilities, in organizing and integrating community production groups.

The job of putting small industry to work in war production, considering its many difficulties, is off to an impressively good start. To carry it on to the result that will bring us victory — every available machine tool and manufacturing facility hard at work making the things needed by successful warfare—is the duty of every person and organization having contact with small industry. Of these the power salesman and his employer, the electric utility, are clearly among the most useful.

## *An Example of Specific Instructions*

Power salesmen must thoroughly understand the problems involved in securing war contracts before they can advise customers on them intelligently and convincingly. Appreciating this necessity, a certain utility has prepared for its own representatives a booklet that describes in detail the elements of doing business with the government; explains the function of the Contract Distribution Branch of the War Production Board; gives an over-all picture of prime and sub-contracting; discusses pooling of facilities and financing of contracts; lists items required for the armed forces and for civilian needs of government; tells what a manufacturer should do to obtain a war contract, how to solve labor shortage problems, where procurement agencies are located and what each agency purchases. Here are some of the more important instructions for company representatives taken from the booklet.

**1.** Work hand-in-hand with the Contract Distribution Branch Office of W.P.B.

**2.** Understand thoroughly the elements involved in doing business with the government.

**3.** Advise customers how to go about securing war contracts.

**4.** Lend assurance and confidence to customers that they can produce war materials, build enthusiasm among them, stimulate them to action.

**5.** Enlist the assistance of local bankers in financing war contracts for our customers.

**6.** Organize pools in each large community and group of small communities.

**7.** Locate and record vacant plants and buildings that can be used for war production.

**8.** Caution customers to seek only the kind of work they are capable of doing—not to go after contracts that are beyond their ability to fulfill.

**9.** Urge customers to visit and become acquainted at the Contract Distribution Branch Offices of the WPB.

**10.** Get the local Chamber of Commerce to form a War Contract Committee; serve as chairman of this committee if possible.

**11.** See that customers are notified of government invitations to bid on materials they can make, either by the WPB or by bringing it to their attention ourselves.

**12.** If customer fails to secure contract after bidding assure him that the first contract with the government is the hardest; the others that follow will be comparatively easy.

**13.** Maintain close contact ourselves with Contract Distribution Branch of WPB.

**14.** Attend and get customers to attend production clinics that will be held from time to time in our geographical section of the country.

**15.** Urge customers to get on the mailing list of the various procurement agencies of the government.

**16.** Remember the local supply officers of the armed forces in Florida and neighboring states are also procurement agencies of the government, and much equipment and supplies are being purchased daily right here at home.

**17.** If shop is not large enough to handle prime contracts, then urge them to solicit sub-contracts, advising them where to seek such contracts.

**18.** Work with our sales allies, including the War Production Board, the local Chamber of Commerce, State Chamber of Commerce, local bankers, municipal officials, county leaders, labor leaders, local industry pools, patriotic citizens with financial resources, regional representatives and Congressmen and Senators in Washington.

# To Expedite Conversion of Small Industry

## What Electric Utilities Can Do

How may electric utilities cooperate most effectively in the conversion of small industry to war production? What, specifically, are the things for utilities to do?

The answers to these questions are to be found in what electric utilities are doing to expedite conversion. Some utilities are doing much to help the movement along. Some are doing less. Probably only a very few can be said not to be active in some direction or in some degree.

In order to bring together a statement of what many utilities are doing in conversion and thus to say what all utilities can do, or should do as determined by local circumstances, ELECTRICAL WORLD addressed a request to operating utility presidents asking them for reports on the activities of their companies in this urgent matter. The request was mailed February 20. This allowed only a very short time for preparation of replies. In spite of this, however, 49 replies were received in time for study and incorporation in this article.

This large return, plus the fact that many of the replies were much more detailedly responsive to the request than might reasonably have been expected in view of the very short notice, indicates that a significant proportion of the electric utility industry is fully conscious of its responsibilities, and of its opportunities, too, in small plant conversion. On the other hand, the fact that some of the replies received were so brief or so vague as to give ground for suspicion that the particular companies were not very excited about the matter or did not yet quite know what it is all about, may be taken to indicate that publication of this study and its accompanying articles should serve a very useful purpose.

This study was undertaken by ELECTRICAL WORLD as the result of a meeting of the National Conference of Business Paper Editors at which Donald M. Nelson, chairman of the War Production Board, urged the editors to use their publications in all ways possible to accelerate the conversion of small industrial plants to war production. In this presentation ELECTRICAL WORLD is trying to meet Mr. Nelson's request.

Plenty of information on the procedural aspects of conversion is readily available to all persons interested. No attempt is made to duplicate such information here. Instead the intention is to show by example how utilities can assist government and other agencies in conversion of small industry.

## Explanation and Some Observations

So as to give form and order to the information contained in the replies, the results of the study are presented in a collection of "Things To Do" against which utilities may measure the extent and detail of their own activities. The program, so called for sake of convenience only, not because it pretends to be inclusive and in exact order, is an editorial production, based most largely on study of the replies received, next on consideration of what has been said by many men and been printed on many pages on the subject of conversion, its urgency, its difficulties and its tremendous possible contribution to winning the war. Also the program benefitted from consultation with men directly engaged in or closely associated with power sales work. In spite of these efforts to make the program adhere closely to realities, it may seem to men familiar with local conditions and problems of industrial electric service that some of the items are impractical and farfetched. But in these apparent deficiencies much value may be contained; they may have the merit that often is found in suggestions unhampered by preconceptions of what can and can't be done.

Information from the replies is presented in quotations or summaries under each heading of the program, but in addition to these specific things, it is in order to make some general observations derived from the replies.

The first thing to be noted is that the proportion of replies received from the Pacific Coast is very much higher than from any other part of the country. And each reply from that region indicates by its length and detail that the electric utilities there are taking their responsibilities in conversion very seriously indeed. No utility executive needs to make more than one guess as to the reason for this. And, having made that guess, he should ponder it well.

Another observation is that utilities serving very large cities and highly industrialized areas are apparently giving much less attention than others to conversion of small plants. This is merely the statement again of a condition that has often been mentioned—the greatly higher proportion of industrial customers per power salesman that is characteristic of the large utility. The industrial sales departments of utilities serving

compact, highly industrialized areas are so occupied with the problems of big customers that they have not time to maintain effective contact with small ones. From the standpoint of conversion, however, this condition is not so bad as it appears at first glance because government agencies, trade associations and other organizations promoting conversion are more numerous and are able to achieve larger and quicker results in these regions.

## Comments on Government Agency Operations

In the letter of request it was asked that there be included in replies any questions or suggestions regarding the methods or attitudes of government agencies on conversion. This point did not appear very often in the replies; evidently most of the writers passed over it as of no great moment thus indicating no particular difficulties in this respect. Two or three replies commended the government agencies and their personnel; some others mentioned "red tape," slowness of action, necessity for recognition of the naturally higher costs of small manufacturing operations, the discouragement of small manufacturers when higher bids than their own repeatedly won contracts and the unnecessary "secrecy" of contract awards which excites distrust. Probably this condition will be cured by the W.P.B. order of March 3 eliminating bidding on all military supply contracts, which now are to be placed by negotiation except in specifically designated cases. The order also directs that small business receive a larger share of war work in the form of contracts for standard and semi-standard items, thus releasing facilities in larger concerns for the making of more complicated and closer-tolerance products.

A pertinent suggestion made in one reply refers to the relatively large quantities of goods required by single bids and which are more than small shops can deliver. Perhaps instead of asking for bids on a large order for one point delivery, it would be possible to break down the order into smaller quantities each with separate bids and for delivery at different points. This would give opportunity to bid to the plant of limited capacity.

Another suggestion is that some indication be given as to the ultimate requirements of articles needed. This would serve as an index of the effort that should be expended in the conversion of old and the provision of new facilities.

One reply mentions considerable complaint from bidders about the shortness of time allowed between receipt of bid requests and bid opening dates, in view of the length of time that elapses from bid opening to announcement of the contract award. The long time to announcement of award is quite likely to cause a bidder to refrain from submitting bid on a subsequent invitation, which may be even more suited to his facilities, lest he might receive two successive awards and find himself bound to contracts beyond his plant capacity.

A final observation of general pertinence is that utility efforts should not, and the replies indicate that in most cases they do not, duplicate the work of established government agencies. They supplement it. The power salesman may be looked upon as an exceptionally useful servant to the various procurement activities of government, one whose aid is needed and welcomed.

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# *THINGS TO DO*

## Organize for the Work to Be Done

**1** Make the industrial sales department, or the greater part of it, a specialized group for planned, vigorous, consistent and continuous activity in conversion under competent direction and including specific assignments and responsibilities of individuals. There should be a system for recording work in progress and for reporting results and also arrangements for local publicity on what the utility is thus doing in cooperation with other agencies to put local industry on a war footing.

**"We established, as a function of our new business staff, responsibility for interviewing and keeping in close touch with all machine shops, garages and processing establishments which in any way might take on a prime contract or a subcontract. Our commercial and industrial sales people have been coached in details of the contract distribution program and they work directly with individual customers."**

**". . . converted our entire staff of industrial and commercial salesmen into a service organization."**

**". . . preparing reports on the operations of local manufacturers for the benefit of the Chamber of Commerce . . ."**

**". . . discontinue the active solicitation of peace-time power business, devoting our energies entirely to assistance in war production."**

The long quotation states the impression taken from many of the replies as to how the utilities are going about doing their share in expediting conversion. Evidently the general disposition is to regard conversion as a job to be performed by existing power sales groups and without any separate or especially planned organizations. In some letters mention is made of individuals, single or several, detailed to maintain close contact with interested government and other agencies.

A couple of replies were accompanied by copies of advertisements in newspapers telling how industrial power representatives can help and are helping to get war contracts for local manufacturers.

## Study All Available Information

**2** Collect, study and act on information pertinent to conversion in newspapers, trade press, government agency releases, etc.

". . . arrangements were made with WPB to furnish us every three or four days with a list of the contracts to be awarded during the next week or ten days. Our representatives study these lists and pass on information concerning the pending awards to those of our customers likely to be interested in bidding."

". . . aids made available to each contact man . . .

" 'Victory'—bulletin of the agencies in the Office of Emergency Management.

" 'W.P.B. Contract News'—published by Production Division, Contract Distribution Branch, New York City.

" 'Priorities and Allocations'—Published by the Research Institute of America, Inc.

" 'How Your Business Can Help Win the War'—published by Simon & Schuster.

[Editor's Note: There is now available a later publication of the Research Institute, "Producing for War," entirely devoted to detailed exposition of the problems of industrial conversion.]

This item in the program of "Things to Do" may seem rather unnecessary because hardly anyone directly or indirectly associated with manufacturing can hope to escape the continuing flood of conversion literature of all kinds, shapes and sizes. Too frequently, however, when information comes along so fast, one pays to it less attention than it deserves and makes little or no effort to collate and organize it for effective use or even, perhaps, to see that it does not flow right on into the waste basket. Putting this material into the care of an intelligent filing clerk will pay good dividends in information at hand when needed.

## Watch Developments in Conversion of Whole Industries

**3** Keep informed of activities of WPB-industry committees such as those that arranged the conversions of the automobile, washing machine and other industries.

Specific references to this point are found in only a few replies, those from automobile manufacturing areas. One remarks that conversion is no new thing to the automobile industry which has long been in the habit of converting to new production every year. Another points out that established supplies of parts to motor car manufacturers are, with some exceptions of chromium platers, makers of laminated glass and other specialty producers, already at work on subcontracts from their regular customers now making, or quickly getting ready to make, war goods. A third reply from an automobile manufacturing area estimates "that over 90 percent of our industries, large and small, have already been converted to war production."

However, there will be more vertical conversions of industries than have so far been made. Not all the now, or later to be, converted industries are so closely integrated as to operations and as to locations of plants as was the automobile industry. It is quite possible, even probable, that many small manufacturers not considered as integrated components in one industry more than another will discover themselves greatly affected by nation-wide conversions of particular lines of production. Such effects should be foreseen and provisions made to meet them.

## Promote and Organize Production Pools

**4** Investigate, analyze and promote all possibilities for pooling or otherwise integrating local manufacturing facilities either on the basis of combined production on one or more contracts or as a community effort to keep local plants in operation.

". . . some eleven or twelve small businesses were grouped together . . . not only able to obtain a contract as a group, but members of the group, because of the fact that they were a compact body received individual contracts from various governmental agencies. Many other such cooperative groups are in process of formation."

"We work with representatives of the Contract Distribution Branch toward the formation of production 'pools' in the communities where they are possible."

"We got the Navy to put our local boat building facilities (small boats, Ed.) on the list to receive bid proposals. We aided the boat builders in forming an association so they could bid collectively. They have bid and are continuing to bid."

"Several customers formerly engaged in the operation of repair shops are now cooperating on production of war materials, that is, have contracts for performing certain machine tool operations."

"We have been cooperating with a local woodworking pool organized something over a month ago, a leather pool organized shortly thereafter and a more recently organized, large, all-inclusive and primarily metal pool. The last named, with over one hundred members, is making an effort to locate a steel casting foundry here from which the machine work can be spread out to individual members. We are a member of this pool and are working very closely with it."

The now classic example of York, Pa., in pooling local industrial facilities which has been so widely publicized has inspired much emulation. In large industrial centers pooling has been very effectively organized by industrial groups and in some instances by companies set up for that specific purpose. In smaller communities, however, where production facilities are largely in factories supplying local and regional markets and in repair shops, garages and the like, there are great, and as yet only little realized, opportunities for the electric utility to take the initiative in combining these facilities. It is not enough for the utility to take a census of tools, report it to the nearest WPB branch office and then wait for the listed customers to be handed contracts. The facilities must be organized into a production unit and its capacities and capabilities sold. In many cases no other is so well qualified and so interested as the electric utility to lead in such activity.

## Coordinate with Government Agencies

**5** Maintain close and continuous contact with local or nearest branch offices of War Production Board, Army and Navy procurement and other government agencies concerned. Also keep in touch with local and state chambers of commerce.

**"We have, for several months past, been devoting a great amount of our sales effort to the matter of coordinating the work of the contract Distribution Divisions of the Office of Production Management, later the War Production Board, with our industrial customers."**

**"We have familiarized ourselves with the field offices of the Contract Distribution Branch and with the general procedure for disseminating information on materials required. We cooperate directly with those offices and act as liason between them and our customers."**

**"Our principal activity in assisting our industrial customers to change over from peace- to war-time economy has been in cooperation with War Production Board and with our local Chamber of Commerce."**

**"Frequently we take customers to the local offices of the War Production Board or Ordnance Department to discuss arrangements for subcontracts or goods to be manufactured."**

Quotations to the same tenor as these could be taken from practically all the replies, including those less responsive to the letter of request. Thus it may be concluded that electric utilities generally are among the most active of local interests in getting war goods contracts for local manufacturers.

## Use the Selling Force of Example

**6** Compile, and use as examples, a file of successful conversions, with emphasis on local instances and with as detailed information as is possible in each case.

**"In our general sales department we collect all the information we can from all kinds of sources as to various industries converted to war production. We send compilations of this information at intervals to all of our representatives who contact industrial customers and, in addition, we specifically seek out customers engaged in non-war production and tell them of other concerns in the same lines of business, and usually with the same kinds of equipment, who have converted to war orders, how conversions were made, etc."**

Probably records of conversions are being kept more generally than is shown by a reading of the replies.

It is also probable that records being kept are very meager, consisting only of the name of the company, its former product and its present contribution to the war effort—little about how the conversion was made, what special circumstances facilitated it or what particular difficulties were overcome. Such information, so helpful when a similar case arises, is usually locked away in the mind of the man who did the job and he may have been taken into the Army last week or be home enjoying the mumps, be some place where he can't be reached when the information is needed. Also, memory is not as good a record keeper as words on paper. Of course, things are moving so fast, everyone is so busy and writing reports takes so much time, that the value of records receives scant appreciation. But the value is there and it will be realized either by the absence or by the presence of needed information.

## Make Fullest Use of Product Lists

**7** Obtain and use lists of wanted products and parts in sufficient quantity, or reproduce them from an original copy, so that every power salesman and other interested persons may have copies.

Practically all of the replies indicate, or the inference may be taken from them, that lists of wanted products and parts, furnished by WPB, by the Army and Navy and by large contractors, are effectively used by power salesmen. And, parenthetically, it may be observed that many of the wanted goods are actually or nearly identical with the normal products of many small manufacturers. But such lists, coming from various sources at various times and in various quantities, do not realize their maximum usefulness unless they are coordinated and made available to every person who can possibly have use for them.

## Learn Local Production Capabilities

**8** Study the machine and other production facilities of local manufacturers to determine their capabilities for production of war goods.

Out of the 49 replies received 29 mentioned surveys or studies of local production facilities. In many cases actual listings of machines, their descriptions, sizes, drives and possible work tolerances were made, set up in card files and reported. Except in larger industrial centers, it is very probable that today the local utility is personally acquainted with every lathe, drill press, shaper and miller in its service territory. And, according to the replies, some utilities are going over the ground a second time to be certain that no possibility for local production of war goods is overlooked.

## Keep on Selling Service Advantages

**9** Continue, with even greater intensiveness than before, the regular functions of power sales — suggesting improvements in customers' uses of service and promoting new and more efficient electrical applications.

**". . . be of real assistance to industrial customers . . . by advising on electrical processes that would short-cut costs and increase production rates so that they could qualify in bidding."**

**". . . advice as to the economical use of electricity for factory and office lighting, electric heating of all types, motor applications, demand control, etc."**

**"All of our industrial representatives are alert to any difficulties with which their customers may be faced. They give advice and counsel in matters relating to new processes and the adaptation of existing equipment to handle war orders."**

**"A staff of ten men in the power division have been kept very busy."**

**"Our power salesmen are also rendering valuable assistance to our customers engaged in the war effort toward improving efficiency and increasing production through the use of better lighting, electric heat, infra-red radiation, etc. They are continually advising customers on the efficient and economical use of electric services and facilities and the conservation of materials."**

Many more such quotations as these could have been reproduced from the replies received. But these suffice to show that the electric utility and its power salesmen would have had plenty to do expediting production of war goods even without undertaking responsibility in conversion.

## Know Where to Get the Money

**10** Get all available information as to local and other financial sources to assist customers to find money for plant revisions and extensions and for working capital necessary for war goods production.

This point is mentioned in only one of the replies. Perhaps it does not properly come within the province of electric utility interest. Nevertheless it would certainly seem a good thing for utility men contacting small manufacturers to know where and how they can obtain needed financial aid. Even though the manufacturer does not normally discuss his financial difficulties, if any, with the power salesman, the latter often knows or can surmise them and may be able to offer a welcome suggestion. And if proposals in Congress at the time of this writing go through for a Federal corporation set up expressly for financial aid to small industrials to accelerate conversion, then certainly the power salesman should know in detail how such aid could be obtained.

## Sell the Idea of Selling

**11** Sell customers on the idea that they can not wait for war production contracts to come in over the transom, that they must go after the war business in the same way, or even more vigorously than, they would go after any other. Get across to customers the idea that now they must sell, not products, but ability to produce.

**"Many of the small plants are considerably discouraged by delays in obtaining some of this war production business. No doubt a part of the blame is due to lack of initiative in going after this business. We are endeavoring to assist and stimulate those concerns toward going after this business as well as gearing up for it."**

**". . . active business solicitation on the part of these plants is recognized as essential."**

**"It is well to remember that the Contract Distribution Branch is only an "aiding" agency. It is no substitute for personal initiative on the part of industrial management."**

(For other references on this point see the separately presented plans for two utilities which appear on pages 75 and 80).

Of all the items in this collection of "Things to Do," this is the most important. The biggest and the most difficult part of the job of conversion is to arouse enthusiasm for it in the mind of the small manufacturer. Not the easily awakened, "Hurrah, boys" kind of enthusiasm that soon spends itself in the face of difficulties and disappointments, but the enthusiasm that turns into abiding determination to do the job, that calls upon every resource of enterprise, initiative, skill and ingenuity. It is the enthusiasm that responds to such a call as was made by Donald M. Nelson, chairman of the War Production Board, in a recent radio talk:

"Where is your initiative? Where is your enterprise? Can you show us what you can do? There isn't time for the Army and Navy to determine what every plant can make. There must be initiative and enterprise at the other end of the transaction."

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To be downright specific at the last, here's the present working plan of one utility:

**1.** Make a careful recheck and study of each manufacturing plant to determine what kind of work, considering the machine tools available, the plant could handle, and the various kinds of products or parts thereof, required by the defense program, that could be manufactured in the plant.

**2.** Instead of the small manufacturer waiting for an invitation to bid on a defense order, we propose that he go after this business by contacting many of the large manufacturing concerns known to have defense contracts with a view of soliciting some part of the business as a sub-contractor.

**3.** Our plan provides that most of this solicitation by the small manufacturer will be by letter. This letter will explain in detail the product manufactured at present, and present a detailed list of all machinery, a statement as to the work which has been done in the plant during the past as well as a list of equipment manufactured, along with any recommendations from users of the product as to the quality of the product or the work performed. Later on, any active inquiries will be followed by a personal call.

**4.** If, for any reason, the customer is not equipped to send out letters we will even write them and do the necessary mimeograph work for him.

# Pennsylvania Power Plan Aids Small Business

***Local coordinating committee prepares "Production Equipment Census" and company's power sales engineers become liaison men in procuring defense business for power customers — Forestalls priority unemployment***

***N. F. VIDAL,* Pennsylvania Power Company, New Castle, Pa.***

THERE probably never has been a time when power sales engineers can be of more assistance to their customers, their communities and their government than at present. From all present indications this will be even more true in the months to come and every power man must help his customers tackle their new problems and be prepared with a lot of the answers.

A year ago industrial activity throughout the country had risen sharply in response to the defense program. In many cities a shortage of skilled labor had already developed and new men were being taught skilled work with all possible speed. But there was one city in the territory served by Pennsylvania Power Company which had available a large supply of labor and a number of relatively small shops which had many idle hours of machine tool capacity and no defense business. Here was a situation which needed help and the company was able to be of service.

### *Results of Assistance*

What were the results of this assistance?

First — Our industrial customers realize that the power men know more about the over-all productive capacity of the community than any other men in town. They look to the power men for valuable help.

Second—Several plants became in-

**PENNSYLVANIA POWER PLAN HELPS THESE CUSTOMERS—Typical medium-sized machine shops—Pennsylvania Power customers—which were brought into the production field and now are very active in national defense work. Plants were interested in defense work by power sales engineers months before scarcities of materials forced them to the wall, and as a result there has not been one man-hour of priority unemployment**

* Superintendent of power sales.

terested in defense business months earlier than if they had waited until forced into it by scarcities. They have the advantage of a head start.

Third—Although no pooling contracts have been secured up to this time, most of the plants have taken defense orders and are doing a nice job with them. In most cases a power man helped make the contract that resulted in this business.

Fourth—Up to now there has not been one man-hour of priority unemployment in the community to the best of our knowledge.

Fifth—It has brought us infinitely closer to our industrial customers than ever before. This mutual understanding and confidence should be helpful for years to come, because we expect to go through this whole thing again backward, if you please, when the emergency ends.

### *Co-ordinating Group*

The community involved was an industrial town with several large plants, all of which were expanding and very busy. A few of these had machine tools not busy all through the 24 hours and then there were the smaller machine shops and related metal working shops, a fireworks factory, a foundry and other small manufacturing concerns. No survey of the equipment had been made, so that none of the plants knew what machines and abilities the others possessed.

A four-man, coordinating committee was formed, consisting of a banker, a retired manufacturer, a representative of the local community association and the general manager of the power company. This committee had three objectives. The first was to act as a clearing house for all defense work inquiries and information; the second objective was to assist the local plants in pooling their productive abilities, and the third was to try to develop new industry, allied with defense activity but of a type which could be converted to peacetime products later.

To work with this committee, our power sales department facilities were made available and the work become their number one assignment.

Representatives of each plant met with the committee and the plan was outlined to them. Each one agreed that a close degree of cooperation would be helpful and expressed approval of the plan for an immediate productive equipment survey.

Just at this time the National Association of Manufacturers' survey was inaugurated. The power men immediately took charge of following up each questionnaire, making sure that it was properly completed. The data were copied before the survey forms were returned.

### *Production Census*

From this summary a 21-page booklet was prepared, known as the "Productive Equipment Census" of the community. The make-up was such as to make it easy to study the types of work which each plant or any combination of plants would be able to do.

It was divided into five sections. Section I showed machine tools by class of tool, plant and the idle hours. For example:

Planers
Cincinnati 30"x32" Plant No. 11 Idle hours 18
Bed planer 54"x54"x16'-0" Plant No. 14 Idle hours 8

Section II showed foundry and forging equipment; Section III, fabricating; Section IV, heat treating; Section V, miscellaneous. Under the last heading were metal saws, presses, draw benches, and equipment not otherwise classified.

Following these in the booklet was an inventory of the machines, equipment and idle hours, listed by plants. Plant names were shown in the front with their key numbers.

This material was then analyzed and a broad picture began to emerge, indicating the rather surprising variety of machines available in the combined group of plants. Some of the plants at that time showed only a mild interest in departing from their standard work and taking on defense business.

Armed with this productive census, and a labor analysis showing available labor by skills, the power company sent letters to many manufacturers who had received large defense contracts. A letter went to all aircraft manufacturers as well. It was a brief summary of the types of work the community was in a position to do and invited inquiries, together with drawings.

Many replies came in. Some drawings and specifications were received. Several replies asked for listing of specific equipment, such as "How many turret lathes do you have, what sizes, and what condition are they in?" At first, each set of drawings was taken out to the plants by the power man and carefully gone over. Before long the power man knew pretty well what kind of work each plant was capable of producing, what tolerances could be met and what types of job each plant was suited for. He could tell from the quantities required whether that job should be done on an engine lathe, turret lathe or automatic screw machine. As these facts emerged, he could scan the drawings and specifications and refer them to the particular plants which might be able to take care of some or all of the processing involved, thus saving a great deal of his customer's time. For example, one concern wanted some precision parts made in moderate quantities, but the power man, from his knowledge of available facilities, knew that the tolerances were much too close for any of the local plants to handle. Consequently, the drawings were returned to that concern, stating that such work could not be done locally. No time of local manufacturers was taken in fruitless discussion.

One of the plants, which at first had shown only a slight interest in machine tool work (it had a good-sized machine shop used for its own tools and dies), began to display an increasing interest in taking on such work. But it pointed out that its automatic screw machines were old and so worn that it would be impossible to hold within close working limits. The power man suggested that another local shop had metalizing equipment and could build up and refinish the worn parts of the automatics, and thus modernize them. From that time on, after modernization, this plant has become increasingly active in sub-contracting work, having added a man to spend full time handling it.

### *Help from State*

As another means of helping the situation, the coordinating committee asked for help from the State Department of Commerce, which responded by sending a representative, who spent considerable time on the assignment. His help was invaluable. Because of his state-wide experience and contacts, he contributed a great

many ideas. In particular, he worked along the lines of developing a new industry for the community.

The State Department of Commerce was receiving many inquiries on defense work from prime contractors. These were forwarded to the power company direct, which in turn reproduced them and sent them to each local plant having any interest in that particular type of work.

### *Visit Ordnance Offices*

The power men took small groups of plant men to the Army Ordnance Offices in Pittsburgh to examine displays of ordnance materials needed. This gave these men a chance to talk to the officers in charge and a number of good leads developed. Army men came out to inspect the facilities of certain plants. Of course, the Productive Equipment Census was placed in the right hands in the Ordnance Office.

The nearest OPM representative was contacted and the survey gone over with him. Plant men were advised to discuss problems with him. More recently the same thing has been done with the Division of Contract Distribution.

The power man acted as a liaison man in one instance, involving four plants. A fireworks company expressed a willingness to take a prime contract for a parachute flare. This was somewhat surprising, inasmuch as the loading of the powder was the last operation and not the biggest part of the job. Since the flare was to be self-propelling when dropped into a Stokes mortar, there was a considerable amount of machining work to be done on the projectile and firing mechanism. It also involved some aluminum tubing. The power man arranged a meeting between the fireworks men, a plant interested in tubing, and two machine shops which were capable of machining the heads.

In this same way several other jobs have been worked out, pooling the various resources.

The point is that all through these steps it was the power men who had become the clearing house, the liaison men, and, in a sense, the experts on local defense work.

One large company was preparing to bid on a prime contract for bombs made of cast iron. It had the necessary foundry capacity, but lacked machining facilities. Between the power man and the Department of Commerce representative the company soon found the help it needed to make up its price quotations.

When a production expert from a large out-of-town concern arrived with a carload of blue prints, he sat in the power company's office and plant men came in in rotation to study his needs and discuss sub-contracts. None of his or of the plant men's time was wasted. And the power man sensed that a branch plant might be within the realm of possibilities. Although this did not materialize, it indicates the broad range of usefulness power men can achieve.

When an occasional defense contract representative turned up, his credentials were checked by the power company and he was taken to those plants where he might make a satisfactory connection. One job closed in this manner has proved entirely satisfactory to the local plant.

It is surprising to realize how several industrial plants can have operated almost side by side for years and still know almost nothing about each other's equipment and possibilities. That knowledge is possessed by the power men, and they, therefore, are in a splendid position to help tie those industries together. After all, not many plants of small size actually have machines capable of performing all of the many processes involved in today's complex war materials. And since they cannot readily purchase the additional tools needed, the only recourse is to find the nearest plant with such equipment. Can you think of any one other than the power man who knows that answer?

### *Utility Coordinates*

Even with a Productive Equipment Survey in hand, the Army Ordnance Department or even a large prime contractor cannot take the time to figure out how Plant A could take a sub-contract for a certain sub-assembly, farming out the forgings to Plant C, the welding to Plant D, the sheet metal work to Plant M, back to Plant A for machining, and on to Plant X for heat treating, before Plant Z can box and ship the finished part. But Plant A can get this information with the power man's help and bid on the entire job. Up to now, no better way has been developed.

In our case we have become definitely and closely associated with all matters relating to our local industries and defense work, and are continuing to do so.

When the defense train went through, we helped follow up leads developed there.

One local architect has secured valuable information from us as to how to solicit architectural work on a large munitions plant about to be built near by.

It has been a natural evolution for our men to keep abreast of priority problems and to act in an advisory manner when called upon. Through changing phases of industrial problems, we try to continue to be our customers' first resort.

### *New Defense Product*

In one case, where priority unemployment threatened, we dug up a small operator in a neighboring town who was known by our power men to have some experimental materials under his hat. As a result of getting these two men together, it looks as though a new product may be evolved, which will not only help the defense program but will save a local industry.

The supervisory personnel of the industrial customers served by the company are relying more and more on the company's personnel in case of emergency, and particularly is this true with respect to the operating personnel of the smaller industrial customer, which may be illustrated as follows:

A small machine shop whose responsible management was out of the city was confronted with the necessity of getting out several pieces of defense work. This work required that a blast of air be directed to the point of the cutting tool. The air compressor failed, and the machine operator called the power company, stating his problem, and with the splendid cooperation of another utility which had a portable air compressor, the portable compressor was rushed up to the job, connected to the air lines of the small machine company, the work was turned out on time, and the owners of the business, when they returned, were very complimentary in their praise for the cooperation extended. The out-of-pocket cost to the utilities was nil; the good will which resulted can hardly be computed.

# Use Capacitance Discharge to Locate Cable Faults

*Novel cable fault location method uses noise of high-voltage capacitance discharge as a guide — Discharge audible to ear 100 feet from manhole*

*WILLIAM D. SEAL, Indianapolis Power & Light Company, Indianapolis, Ind.*

ON INDIANAPOLIS 4,100-volt underground a.c. network feeders, which are equipped with ground relays, faults invariably have been of the single-line-to-ground type with resistance in the order of five megohms. While the number and frequency of such faults has not been sufficient to justify any appreciable investment in elaborate fault-locating equipment, some method that was quicker and easier than the old "cut-and-try" system was needed.

Early in 1940 experiments in carbonizing experimental faults in paper-insulated cable, using 60-cycle current supplied by constant-current transformers, accidentally led to a simple but practical fault-locating method.

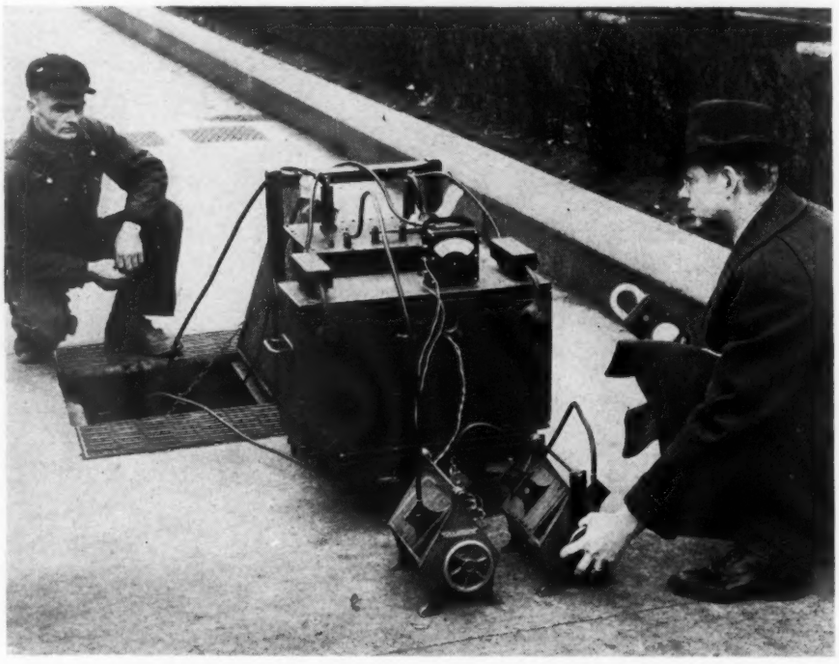
During these experiments, even though a wide range of voltage was available and currents of 1 to 10 amp. were used, it was difficult to reduce the faults to low resistance where any appreciable capacitance was involved. It was noticed, however, that when voltage was raised high enough to break down the fault a loud continuous capacitance discharge occurred at the fault. The very loudness of this discharge led to the thought that it might be put to good use in tracing down cable faults.

Pursuing this thought further, a portable fault-locating set was assembled which consisted of the following equipment:

1. A 220-volt to 11,000-volt high impedance testing transformer for charging the cable.

2. An 80:1 potential transformer and voltmeter for voltage measurement.

3. A carbon pile rheostat in the low-voltage circuit for voltage regulation.



DISCHARGE TYPE fault locating set in use

The transformer that was used was designed to carry short-circuit current. Its inductive reactance was comparable with the capacitive reactance of the average feeder, so that resonance could be utilized to give as high as rated voltage on the high-voltage side even with much less than rated voltage applied to the low-voltage or primary winding. Its resistance was high enough to prevent excessive voltage or charging current in case of series resonance.

In use with the high-voltage terminals of the transformer connected conductor and sheath of the faulty cable, the carbon pile rheostat is gradually tightened while the operator watches the increase in the voltmeter reading. When voltage rises sufficiently to cause flashover or capacitance discharge at the fault the voltmeter reading goes almost to zero because of the low arc impedance. Finding the fault under these conditions is simply reduced to patrolling the faulty cable and listening for the discharge outside each manhole.

With equipment used in this manner as a fault locater, several advantages accrue:

1. Fault location does not depend on carbonization or reduction of the fault to low resistance.

2. Danger of damage to other cables is eliminated because so little

heat is developed at the fault that insulation is not burned and neither conductor nor sheath is melted.

3. Faults can be located without entering manholes and without any field equipment for picking up the signal.

### *Circuit Analysis*

The approximate characteristics of the circuit involving this equipment is as follows:

Transformer voltage ratio = 220 to 11,000 volts.
Supply voltage = 120 volts applied to 220-volt winding.
Open circuit high-voltage terminal volts = 6,000.
Ohmic impedances on 6-kw. base:
Transformer resistance = 970 ohms.
Transformer reactance = 1,511 ohms.
Misc. resistance assumed, 75 ohms.
Misc. reactance assumed, 75 ohms.
Rheostat equivalent resistance, 0 to 2,500 ohms (for 0 to 1.0 ohms actual).

The equivalent circuit used for locating cable faults is shown in the accompanying circuit diagram. In this equivalent circuit the voltage $E_2$, sufficient for causing continuous capacitance discharge through a fault in any cable in the Indianapolis system, is obtained by the following reactions:

$Z$ = Total impedance of the equivalent circuit before flashover.

$$Z = R + jX_L - jX_c.$$

$$I = \frac{E_1}{Z} = \frac{6{,}000}{Z} = \text{charging current.}$$

$E_2 = IX_c$ = voltage applied between conductor and sheath of faulty cable.

Because the inductance and capacitive reactances are in series, $E_2$ can be made higher than the open circuit voltage, 6,000 volts, for any length of cable on this system.

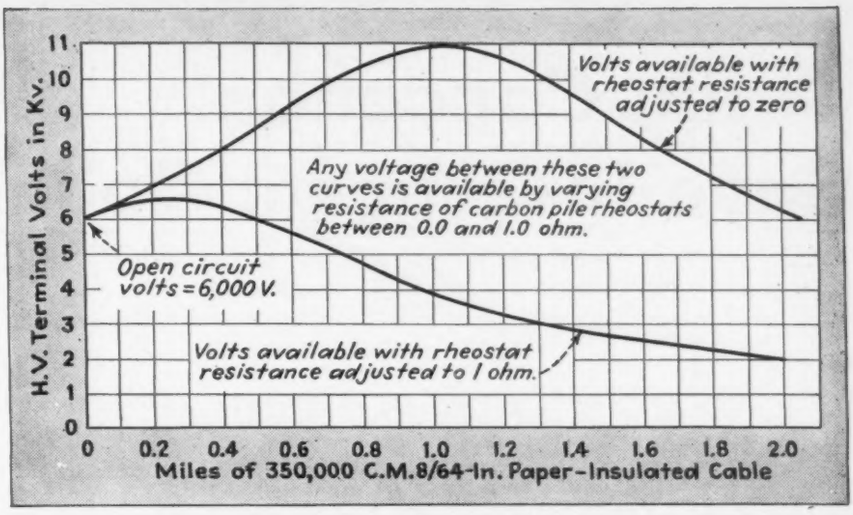
Maximum charging current occurs when the length of cable is such that $X_c = X_L$, when $Z = R$ and $I = \frac{E}{R}$

Maximum voltage and maximum charging current do not occur simultaneously as long as there is resistance in the circuit, because the inductive reactance in the circuit cannot be varied to balance completely any capacitive reactance of the cable.

For any one value of resistance in the circuit, maximum voltage occurs when the length of cable is such that

$$X_c = \frac{R^2 + X^2_L}{X_L}$$

The accompanying curves show the upper and lower limits of voltages obtainable for breaking down faults on cables of various lengths. Experience has shown that the curves are reasonably accurate. For convenience in interpreting the curves, miles of 350,000-cir.mil, single-conductor, 8/64-in., paper-insulated, lead-covered cables, rather than capacitive reactance, have been plotted against H. V. terminal voltage.




**CURVES** show upper and lower limits of voltages obtainable for breaking down faults in cables of various lengths. Terminal volts available for flashing over cable faults with high impedance testing transformer. Transformer voltage ratio 220 to 11,000, or 1 to 50. Supply circuit voltage 120, applied to 220-volt winding

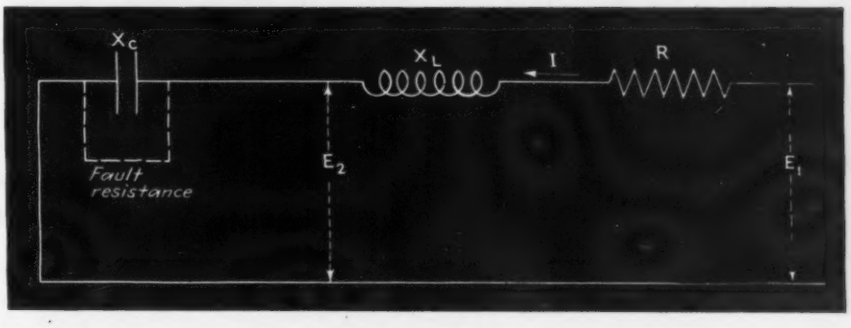
The conversion of capacitive reactance to miles of 350,000-cir. mil cable is based upon a calculated capacitance of 1.14 mfd. per mile per phase. For this capacitance the capacitive reactance is 2,330 ohms for one mile of one phase of single-conductor cable.

### *Experience*

This method of locating cable faults must still be considered in the experimental stage. Its application may be limited to feeders not long enough to require excessive charging current. It may also be limited by the voltage necessary to break down the faults. However, our experience so far has indicated that about 6,000 volts will break down the average fault on any of our feeder cables, whose insulation thicknesses are from 7/64 in. to 12/64 in. of paper.

Using this method, we have located experimental faults in an actual feeder of average length, equivalent in capacitance to 1.1 miles of 350,000-cir.mil cable. The results of these tests have all been satisfactory, with no discouraging results to date. However, it has not yet been tried out with our longest feeder, whose capacitance is equivalent to that of about 1.64

[*Continued on page* 88]




**EQUIVALENT** circuit used for locating cable faults

$E_1$ Voltage applied to low-voltage winding—6,000 volts in high-voltage terms for 120 volts actual.
$E_2$ Terminal volts at high-voltage side of transformer.
$X_L$ Total inductive reactance on 6,000-volt base at 60 cycles.
$X_C$ Cable capacitive reactance on 6,000-volt base at 60 cycles.
R Total resistance on 6,000-volt base, neglecting fault resistance which is very high and is in parallel with the cable capacitive reactance.
I Charging current before breakdown occurs.

# Static Capacitors Save Investment Dollars—I

***New voltage regulating equipment postponed—System peak slightly reduced—Effective reactive capacity much greater than nominal rating***

*R. G. HOOKE,* Public Service Electric & Gas Company*

MAJOR system economies may be effected by installation of static capacitors on distribution feeders. Surprisingly, a large proportion of these savings may appear in the boiler room, the turbo-generator room, the transmission system or the transformer substations, instead of in the distribution plant, which has received most of the attention in studies of this subject up to the present time. It may not be generally appreciated, for instance, that on a system serving a relatively low power factor, highly diversified industrial load 100 kvar. in static capacitors on distribution feeders may save installation of 150 kvar. in synchronous machine capacity.

As a result of an intensive investigation† of a representative area various conclusions pertinent to any economic and engineering study of a static capacitor program were reached as summarized below.

1. Capacitors have no effect on voltage regulation at the point of installation.

2. However, areas of low voltage may have their voltage raised relatively more than areas of high voltage by differential installations of capacitors.

3. Peak demand in kw. may be reduced by an amount equal to 7 or 8 percent of the aggregate kvar. nameplate rating of capacitors installed. But since the kvar. of distribution capacitors may be only one-fifth of the system peak kw. the reduction in demand arising out of reduced losses is less than 2 per cent of peak—too small to be a determinant in planning system capacity.

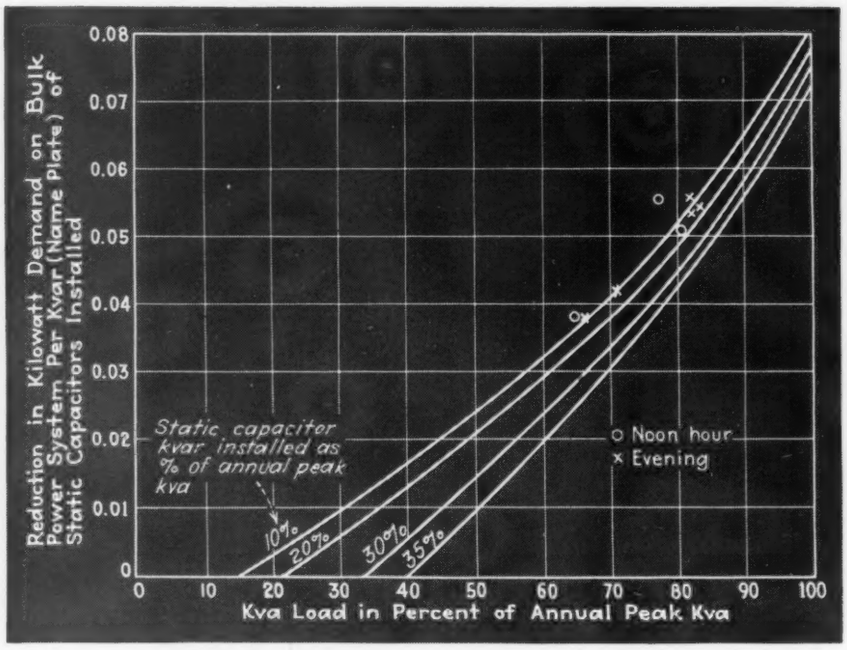



**FIG. 1—Reductions in kilowatt demand due to capacitor installations. Variation in power factor from 74 percent in the evening to 66 percent in the daytime (for the same kva. load) has relatively little effect on the validity of the smooth-drawn curves. Savings per unit decrease as capacitors are increased relative to load kva.**

4. Since system reactance in ohms is usually three to six times as great as system resistance, the capacitors produce an important reduction in reactive over and above their nominal rating.

5. Saving in reactive losses in transformers (substation and switching station) may be three times as great as in the distribution system.

6. Effective rating of a capacitor was found to be 8 per cent greater than its 2.4 kv. nameplate rating because average voltage at average mid-feeder point was approximately 2.5 kv.

7. Actual magnitude of lagging reactive component at times of minimum load limits the amount of capacitance which can be appropriately installed.

### *Basis of Study Described*

In the summer of 1939 an investigation of the technical and economic aspects of an extensive capacitor program was initiated. For this purpose

* Transmission planning engineer.

† See also "A Capacitor Program for Distribution Betterment," by Seely and Jeynes, ELECTRICAL WORLD, August 10 and 24, 1940.

a typical area with a load about one-tenth that of the entire system was chosen for detailed study. It contained five distribution substations (26 kv./4 kv.) ranging in size from 9,000 to 22,000 kva. annual peak demand, three high-tension (26 kv.) customers, approximately 80 miles of 26,000-volt transmission circuits, of which 35 miles was open wire construction and 45 miles was underground, and was served from a 132/26-kv. transmission substation connected to the 132,000-volt bulk power system. The load of the total area was approximately 100,000 kva. Various amounts of static capacitors were assumed installed on 4-kv. distribution feeders throughout the area and the results determined by calculations. These were finally reduced to a percentage basis and, with some adjustments, applied to the system as a whole. The broad conclusion of this analysis was that the program would be highly beneficial; it has now been justified by events.

The capacitors considered were the medium-voltage units designed for shunt operation on distribution circuits in the 2,400-volt range, which, of course, includes 4,150 volts, three-phase supply. Permanent connection to the lines was assumed in all cases; *i.e.*, no automatic switching was considered. The results, as here presented, although quantitatively applicable only to a particular electric system, are undoubtedly illustrative of widely existing conditions.

### *Voltage Regulation*

Any shunt-connected capacitance will draw a leading current from the lines, the magnitude of this current being dependent entirely on the voltage across the capacitor and independent of the load on the circuit. This leading component of the total line current, drawn through the reactance of the system, causes a voltage rise which is independent of the load current. Since voltage regulation is a function of the variation in voltage with load—that is, of the difference between the voltage at light load and the voltage at full load—it follows that *installation of shunt capacitors has no effect on the voltage regulation* at the point of installation. These capacitors raise the voltage at light load and at full load by the same amount, but do not alter voltage variations.

However, by differential installations savings in regulatory equipment may be accomplished. For instance, of several feeders served from one substation, or of several substations from one source bus, some may be close to the lower allowable voltage limit at heavy loads, while others may approach the higher limits at light loads. Shunt capacitors installed in the low-voltage areas will raise potentials in these areas. Although a considerable portion of this rise occurs also on the substation or source bus, it will be less the farther back into the system the effect is studied. Hence the areas of low voltage where the capacitors are installed will have their voltage levels raised relatively more than will areas of high voltage. These devices will, therefore, very often make possible postponement of circuit reinforcements or of additional control equipment, although they will not alter voltage regulation at the point where they are installed. They may be used effectively to coordinate various areas, but not to improve regulation in any one area.†

### *Effect on Kilowatt Demand*

Addition of static capacitors on a system with lagging power factor will raise the power factor and reduce the line currents. Losses will then be reduced in proportion to the square of the change in current. Hence, installation of capacitors reduces the kilowatt demand on the system.

Estimates of the magnitude of these savings (Fig. 1) are not materially affected by ignoring the fact that power factor is not a continuous function of system load.‡ It will also be noted from the curves of Fig. 1 that the greater the load—that is, the more heavily loaded the facilities—the less the differentials between the per unit effects of various-sized capacitor installations.

Peak demand in kilowatts may be reduced by an amount equal to same 7 or 8 percent of the amount of static capacitors installed in kilovars, nameplate rating of the units. That is, for a system with a peak load of 1,000,000 kva. installation of 200,000 kvar. in capacitors on the distribution circuits will reduce the peak kilowatt demand at the generators by some

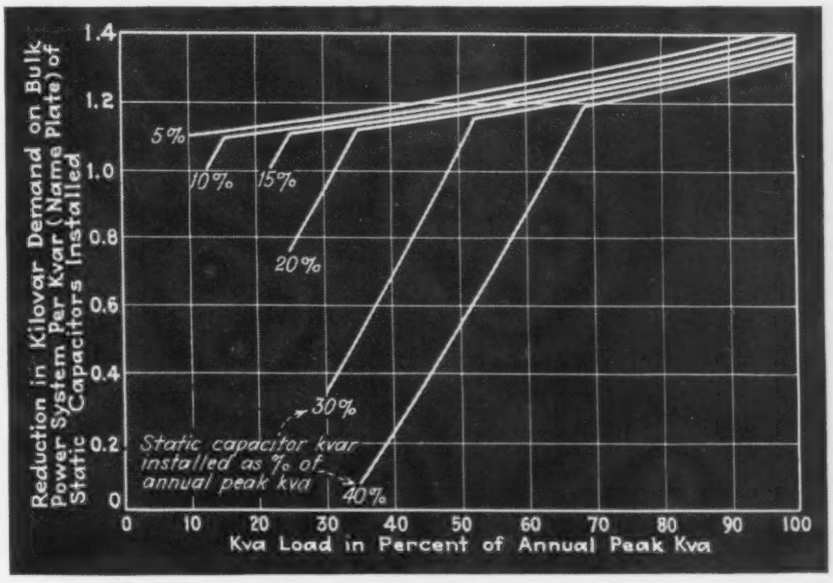



**FIG. 2—Effectiveness of capacitors increases with heavier loadings, but decreases with addition of more units. Sharp break occurs at point where power factor becomes 1.0 for the particular initial load and given capacitor installation**

† This discussion, of course, applies only to fixed installations. If the capacitors are arranged with switches, perhaps being cut into service or cut out automatically with load variation, an entirely different situation is created. Effective voltage control under load may then be accomplished, but at the cost of additional relays and switching equipment.

‡ Theoretically, these curves can be correct only if the power factor of the load is a smooth, continuous function of the magnitude of the load. However, evening conditions, with a power factor some eight points higher than daytime power factors for the same total kva. load (74 percent power factor in the evening, 66 percent in the daytime) were included in these calculations and it was not possible to draw separate sets of curves for the two different power-factor-load relationships. This is clear from the points shown on the chart, which are the results of calculations for various loads, at various times of day and hence at various power factors as experienced for the case with a capacitor installation equal in size to 10 percent of the peak kva. of the area in which the units were located.

15,000 kw. This would probably be somewhat less than 2 percent of the system peak demand in kilowatts. It is too small a saving to be a pertinent element in planning system capacity and it is, therefore, concluded that *no permanent boiler or turbine capacity savings can be credited to a static capacitor program;* at times, such a reduction in peak kw. demands might conceivably cause postponement of new equipment, but almost invariably it would be more than covered by the normal capacity overbuild available and the inherent forecasting errors.

### *Effective Rating*

Effectiveness of an installation of static capacitors installed as a source of reactive power may be very much greater than that of a nominally equivalent amount of reactive capacity provided in generators or in synchronous condensers. In an engineering study of means for supplying reactive demands this factor is of vital significance; for example, a 12,500-kva. synchronous machine at a switching station may be required to afford the relief obtainable by 10,000 kva. of static capacitors.

The most important reason for this is the fact that under normal lagging power-factor conditions the capacitors cause a decrease in line current all the way back to the generators and, hence, a substantial saving in system $I^2x$ losses. System reactance will usually be from three to six times the system resistance. Therefore the amount of this saving may become very important. Incidentally, the reactive losses in substation and switching station transformers were found to be approximately three times those in the distribution plant, which emphasizes again the necessity for making comprehensive studies.

Another frequent reason for the greater effectiveness of the capacitor units is the fact that their actual capacity is proportional to the square of the impressed voltage. The current through the device is equal to the voltage divided by the capacitance of the unit; $I_c = E/b$. The leading reactive load added by a capacitor bank is equal to the current times the voltage; Kvar. $= EI_c$. Therefore, Kvar. $= E^2/b$. Units built for 4-kv. distribution feeders are rated on the basis of operation at 2,400 volts. They are installed on the primary circuits, between phase and neutral, usually at

**Effective Rating at Various Points in the System of Static Capacitors Installed on Distribution Primary Circuits**

| | |
|---|---|
| Nameplate rating of capacitor bank..... | 100% |
| Effective capacity at average point of installation on the average primary distribution feeder; depends on operating voltage at point of installation..... | 108% |
| Effective capacity at substation 4-kv. bus; depends on electrical constants of primaries from substation to capacitor installation and on loads, range..... | 110% to 115% |
| Effective capacity at a source bus for subtransmission (13 or 26 kv.) circuits; depends on circuit constants and loads, range ..... | 113% to 130% |
| Effective capacity at high-tension bus (132 kv.) in the bulk power system, range ..... | 115% to 140% |
| Effective capacity at a generator bus when the transmission system involves both high voltage and intermediate voltage lines, range ..... | 120% to 150% |

points between the first and last transformer. The normal potential at such locations on the system studied is approximately 2,500 volts (2,465 average to neutral at the last transformer and 2,530 at the first transformer). At the point of installation, therefore, the effective rating of the average capacitor is $\left(\frac{2,500}{2,400}\right) 2 =$ 1.08, times its nameplate rating.

Thus the nominal rating of a bank of capacitors considered as a source of reactive capacity can logically be increased by an appropriate amount to represent the effective value of the capacitors at the substation or switching or generating station. The amount of the increase will depend first on the load carried (its magnitude and power factor), which means that the effective rating will vary somewhat from light load to full load; second, on the line and transformer reactances (system $x$) from the point in question to the capacitor bank, and, third, on the ratio of operating to nominal capacitor voltage (which may result in a decrease in rating in some instances). Economic studies, of course, should be based on comparisons of equally effective amounts of reactive capacity.

At light loads the effective value of large installations of capacitors is less than the nominal value (Fig. 2).¶ This, of course, is because the capacity installed exceeds the load to be carried and becomes itself a load. Also, the larger the amount of capacitors, the less increase in capacity per unit above nameplate is found. Saturation is occurring. At the generating station the reduction in reactive demand due to installation of capacitors as a source to carry reactive load may be as much as 150 percent of the nameplate rating of the units.

Also, since minimum load is about 25 percent of annual peak kva., it appears from Fig. 2 that a capacitor installation of about 15 percent of annual peak kva. will result in no generator reactive demand (unity power factor) at light load times. Unless generators are to be operated at leading power factors, therefore, this indicates one limiting consideration in the size of a capacitor program.

Of course Fig. 2 applies only to a particular system wherein a large portion of the load is served through step-down switching stations connected to a 132-kv. bulk transmission plant. The accompanying table gives ratios which indicate the range of the progressive increases in effective capacity from the point of installation back through the system to the generators. In general, the loading and circuit constants will determine the final selection of the ratio to use in any particular instance.

In a subsequent article specific instances of use of shunt capacitors to permit postponements of major investment will be presented, and it will be shown that annual savings in losses are a vital element in economic studies of capacitor installations.

¶ In these data, as in those on which Fig. 1 was based, discontinuities in the load-power-factor relationship proved to introduce only minor irregularities in the curves.

## Use Capacitance Discharge to Locate Cable Faults

[*Continued from page* 85]

miles of 350,000-cir.mil cable, and will require more charging current than has been necessary so far. Charging current is about 2.58 amp. per mile of 350,000-cir.mil cable at 6,000 volts.

In December, 1940, we successfully located the first and only actual fault to occur since the method has been developed. This fault was located in a 2,000-ft. length of No. 4/0, 12/64-in. paper-insulated cable. The capacitance of this cable was equivalent to that of 0.22 miles of 350,000-cir.mil cable; about 6,400 volts was required to start and maintain the discharge at the fault. The fault was found in a manhole within ten minutes. The discharge was audible to the unaided ear 100 ft. away from the manhole.

# Appliance Service Forms Simplified

***Operating and record functions adequately performed by only two forms, one of which acts also as an effective collector of immediate payment for repair work done***

*H. F. WOODALL,* Atlanta Division, Georgia Power Company*

MINIMIZATION and simplification of paper work to be done by men in the field were sought by the Georgia Power Company in setting up forms for keeping track of time and materials used in appliance repairs on customers' premises. Also there was needed a continuing record of repair parts carried on trucks to insure that quantities and varieties would always be adequate for normal work. Another consideration was to encourage payment for work at the time repairs were made, thus to obviate billing and collection expense as much as possible.

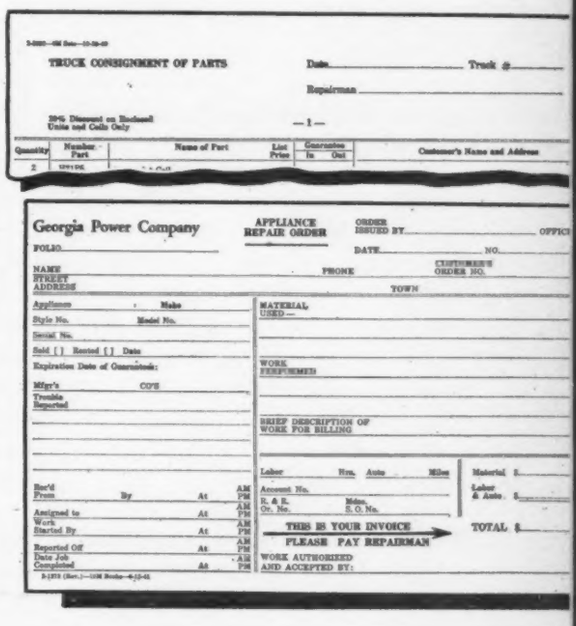
The two forms here reproduced were evolved from long experience in the problems of appliance repair administration. They have proved to be entirely satisfactory in accomplishment of the three purposes stated.

Another form, "Truck Consignment of Parts," lists all of the items carried on each truck. The complete list accompanies this article. The form, made out in duplicate by the service man when he returns to the shop in the late afternoon, serves as a requisition on the stockroom for replacement of the repair parts used during the day. It gives the names and addresses of customers on whose appliances parts were used and thus is a check on the accuracy of information on the second form. It includes a price list so that charges can be figured on the job.

The second form, "Appliance Repair Order," is made out in triplicate when each job is finished. It is signed by the customer as authorization and acceptance of the work done. As the customer signs, her eyes cannot escape seeing the words and arrow, all printed in red ink, drawing attention to the total of the charge. Before this detail was added to the form repairmen were instructed to collect cash if they could and were offered a bonus based on the amount of money collected. This resulted in cash payment of about 5 percent of all charges. Since the addition of the red arrow with the suggestive words above and below it cash payments have increased to around 20 percent, and that without any verbal solicitation. If the customer asks, she is told that the charge can be added to her electric bill. But rather than ask, thus implying that the money is not at hand, many customers pay then and there.

One of the three copies of the form is left with the customer, either as a receipted bill or simply as a memorandum of the work done. The two other copies are turned in as justification of requisition for replacement of repair parts on the truck as basis for billing of unpaid charges and as record of time, material, transportation on repairman's daily work.

The information on the second form is sufficient for almost any kind of analysis or study of different elements in appliance service work. Comparisons in personnel efficiency and skill based on times required to perform particular work, in costs of labor, materials and transportation, in costs of different kinds of repair jobs, in lengths of time various appliances operate before repairs are needed, in characteristics of devices as regards repairs and in other aspects of the appliance service problem—all such comparisons are possible from the record of this form. And, to repeat, it is most satisfyingly effective in encouraging instant collections for repairs.



TRUCK CONSIGNMENT OF PARTS

Date _____ Truck # _____

Repairman _____

20% Discount on Enclosed Units and Coils Only

— 1 —

| Quantity | Number Part | Name of Part | List Price | Guarantee In | Guarantee Out | Customer's Name and Address |
|---|---|---|---|---|---|---|
| 2 | [illegible] | | | | | |

Georgia Power Company — APPLIANCE REPAIR ORDER

ORDER ISSUED BY _____ OFFICE

FOLIO _____ DATE _____ NO. _____

NAME _____ PHONE _____ CUSTOMER'S ORDER NO. _____

STREET ADDRESS _____ TOWN _____

Appliance _____ Make _____ Style No. _____ Model No. _____ Serial No. _____

Sold [ ] Rented [ ] Date _____

Expiration Date of Guarantee: _____

Mfgr's _____ CO'S _____

Trouble Reported _____

MATERIAL USED — _____

WORK PERFORMED _____

BRIEF DESCRIPTION OF WORK FOR BILLING _____

Labor Hrs. Amts. Miles Material $ _____

Rec'd From _____ By _____ At _____ AM PM

Account No. _____ Labor & Amts. $ _____

Assigned to _____ At _____ AM PM

R. & R. Or. No. _____ Miles R. O. No. _____

Work Started By _____ At _____ AM PM

THIS IS YOUR INVOICE — PLEASE PAY REPAIRMAN — TOTAL $ _____

Reported Off _____ At _____ AM PM

Date Job Completed _____ At _____ AM PM

WORK AUTHORIZED AND ACCEPTED BY: _____

**FORMS used in appliance service department of Georgia Power Company**

TRUCK CONSIGNMENT OF PARTS

| Quantity | Part Number | Name of Part |
|---|---|---|
| 2 | H21P6 | Hot Point Coil |
| 2 | H23P6 | Hot Point Coil |
| 2 | H70P12 | Hot Point Coil |
| 2 | H72P12 | Hot Point Coil |
| 1 | C6P6 | Hot Point Coil |
| 1 | C30P6 | Hot Point Coil |
| 1 | C28P6 | Hot Point Coil |
| 1 | H21P12 | Hot Point Brick |
| 1 | H23P12 | Hot Point Brick |
| 1 | R39P427 | Pilot Bulb |
| 1 | R41P1044 | Door Spring |
| 2 | R41P1060 | Door Catches |
| 1 | SW40P2 | Hot Point Switch |
| 1 | SW65P2 | Hot Point Switch |
| 1 | SW92P2 | Hot Point Switch |
| 1 | SW100P2 | Hot Point Switch |
| 1 | SW106P2 | Hot Point Switch |
| 1 | SW111P2 | Hot Point Switch |
| 2 | SW40P9 | Switch Button |
| 2 | SW65P7 | Switch Button |
| 1 | SW128P7 | Switch Button |
| 1 | Y28P1 | Contactor |
| 1 | 131H106 | Calrod Unit |
| 1 | 132H107 | Calrod Unit |
| 1 | H67P130 | Contact Assy. |
| 1 | H70P47 | Adapter Ring |
| 1 | 560620 | Westinghouse Thermostat |
| 1 | 413697 | Westinghouse Switch |
| 1 | 691611 | Westinghouse Switch |
| 1 | 933699 | Westinghouse Switch |
| 1 | 988602 | Westinghouse Switch |
| 1 | 712283 | Corox Unit |
| 1 | 708118 | Westinghouse Corox Unit |
| 1 | 980613 | Relay Resistor |
| 1 | 959619 | Pilot Light Resistor |
| 1 | T55 | L. & H. Switch |
| 1 | T56 | L. & H. Switch |
| 1 | 98 | Pilot Light Bulb |
| 1 | RC9 | Chromalox Unit |
| 1 | RC7 | Chromalox Unit |

| Quantity | Part Number | Name of Part |
|---|---|---|
| 1 | RC6 | Chromalox Unit |
| 1 | RA30 | Chromalox Coil |
| 1 | RA62 | Chromalox Coil |
| 1 | RA35 | Chromalox Coil |
| 1 | RA62-2 | Chromalox Coil |
| 1 | RA82 | Chromalox Coil |
| 1 | TE65 | Chromalox Unit Terminal |
| 1 | TE79 | Chromalox Unit Terminal |
| 1 | K30 | Chromalox Unit |
| 1 | K37 | Chromalox Unit |
| 1 | K36 | Chromalox Unit |
| 1 | W6 | Adapter Ring |
| 1 | W63 | Adapter Ring |
| 1 | W682 | Adapter Ring |
| 1 | W7 | Adapter Ring |
| 1 | W7-2 | Adapter Ring |
| 1 | W9 | Adapter Ring |
| 1 | W9-2 | Adapter Ring |
| 1 | H7 | Adapter Ring |
| 1 | H75 | Adapter Ring |
| 1 | H9 | Adapter Ring |
| 1 | U7 | Adapter Ring |
| 1 | U75 | Adapter Ring |
| 1 | U9 | Adapter Ring |
| 1 | L7 | Adapter Ring |
| 1 | L75 | Adapter Ring |
| 1 | L9 | Adapter Ring |
| 4 | 600 watt | Chromalox Coil |
| 4 | 750 watt | Chromalox Coil |
| 4 | 1000 Watt | Chromalox Coil |
| 2 | 5406 | Rubber Range Cables |
| 12 ft. | | Rgn. Switch Leads, not |
| 12 ft. | | Rgn. Thermostat Leads |
| 1 | W1202 | Pulley |
| 1 | W2021 | Pulley |
| 1 | | Shaft |
| 1 | W1264 | Clutch |
| 2 | W1190 | Reverse Gears |
| 1 | W1191 | Pinion Gear |

| Quantity | Part Number | Name of Part |
|---|---|---|
| 1 | W1197 | Coupling |
| 1 | W1040 | Washer Reverse Gear |
| 2 | W1046 | Washer-Pinion |
| 2 | 3682 | Washer-Clutch |
| 1 | 5450 | Washer Reverse Gear |
| 1 | PA1200 | Coupling |
| 2 qts. | | Washer Oil |
| 1 | A2897 | Coupling |
| 1 | W37 | Attachment Plug |
| 2 | 802 | Drums |
| 1 | | Methyl Drum |
| 1 | | Purge Hose |
| 1 | | Gas Mask |
| 1 | | First Aid Kit |
| 1 | | Gal. Refrig. Oil |
| 2 | 1313 | Gates Belts |
| 2 | 1340 | Gates Belts |
| 1 | 360 | Gates Belts |
| 1 | C16A159 | Low Side Seal |
| 1 | C16A137 | High Side Seal |
| 1 | 11X205 | Gasket |
| 2 | -22415 | Kelv. Seals |
| 1 | 13007 | Valve Plate (Double) Exchange |
| 1 | 13087 | Valve Plate (Single) Exchange |
| 12 | 9022 | Discharge Valves |
| 12 | 13659 | Suction Valves |
| 1 | 21913 | Kelv. Exp. Valve, Exchange price |
| 1 | 33032 | Kelv. TVA Latch |
| 1 | 23048 | Kelv. Thermostat, Exchange price |
| 1 | 21899 | Kelv. Therm. (Changeover), No exchge. |
| 1 | 35035 | Kelv. Pulley |
| 1 | CEA7 | Pulley |
| 1 set | | Motor Mountings |
| 2 | 380 | Gates Belt |
| 2 | 5103 | Gates Belts |
| 1 | 316 | Gates Belts |
| 1 | 410 | Gates Belts |
| 1 | 527 | Gates Belts |

* Appliance service superintendent.

# Editorials

S. B. WILLIAMS, *Editor*

## *Court Review of Rate Cases Not Discarded*

THERE SEEMS to be some question as to how much, if any, the unanimous decision this week of the Supreme Court in the Natural Gas Pipeline Company case changes utility rate regulation. Undue importance attached to the supplementary opinion of Justices Black, Douglas and Murphy gave rise to a quick news interpretation that the case "lays the ghost of Smyth vs. Ames" and opens a new era which will ignore reproduction cost and base utility rates on prudent investment. They call their joint opinion a concurrence, but it has all the appearance of violent dissent and of an effort to inject New Deal social philosophy into the field of rate regulation and of judicial review.

What Chief Justice Stone said in delivering the opinion of the court was: "The Constitution does not bind rate-making bodies to the service of any single formula or combination of formulas. Agencies to whom this legislative power has been delegated are free, within the ambit of their statutory authority, to make the pragmatic adjustments which may be called for by particular circumstances. Once a fair hearing has been given, proper findings made and other statutory requirements satisfied, the courts cannot intervene in the absence of a clear showing that the limits of due process have been overstepped. If the commission's order, as applied to the facts before it and viewed in its entirety, produces no arbitrary result, our inquiry is at an end."

While this is a less rigid rule for determining fair value than laid down in Smyth vs. Ames, there is nothing here to indicate that reproduction cost must hereafter be ignored, and since it says that commissions are not bound to any formula it explicitly denies that rate-making bodies are confined, as implied by the news accounts, to the prudent investment theory. On the other hand, commissions will see in the reference to "due process" an admonition that if they do ignore reproduction cost or any other accepted elements in arriving at fair value they must be prepared, if challenged, to prove that their action was in no way arbitrary.

In spite of the newspaper attention given to the concurring-but-dissenting minority opinion, the dominant issue was not whether the Smyth vs. Ames case sanction of reproduction cost shall be continued. The now validated decision of the Federal Power Commission "reluctantly" accepted a rate base which actually included reproduction cost of new physical properties at $56,302,250.

The real issue between the "majority" and the three justices who differ is whether the courts have any concern with the economic merits of a rate base. No less than Justice Frankfurter himself took pains to enter a flat concurrence with the majority and to decry the claim of the dissenters that rate regulation should reside wholly within the legislative and commission sphere except in extreme instances where the Constitution has been indubitably flouted by confiscatory decision.

The Black-Douglas-Murphy opinion further advanced the theory that rate making was price fixing and that "price fixing, like other forms of social legislation, may well diminish the value of the property which is regulated. But that is no obstacle to its validity." We give emphasis to this opinion here because it gives legalistic expression to the campaign to advance a theory of utility rate making wherein social values rather than the cost of service are to be the determining factors. We see in that theory nothing compatible with the principles of democracy.

Contrary to the first reports on the decision, there is nothing here either to presage a new wave of rate determination or to unduly alarm utilities. On the other hand, the firmness with which the court refused to abdicate on rate matters should be of some comfort to the industry. There is still a Supreme Court to go to which will not permit "due process" to be arbitrarily overridden.

## *Tires and Public Relations*

A UTILITY EXECUTIVE in a large industrial community where the public has been carefully educated in the company's operations with resulting good public relations now asks whether these good relations can survive the tire shortage.

Where a company has built up a reputation for answering trouble calls within 60 minutes, what will happen to customer good will, this executive asks, if to cut the mileage in half and save rubber the trips are "bunched" and the customer may then have to wait as long as 180 minutes? Will the customer complain that

the department store, the milkman and others still call on time, but not the power company? If the number of street light inspection trips are cut in half will the city officials claim that the utility is trying to shirk its responsibilities?

One thing is certain—the maintenance of public relations will not be accepted as a valid reason for getting new tires. Therefore, no matter how hard a company may have tried in the past to forestall complaints, the prudent thing today is to cut down tire mileage wherever possible. Those who run their tires today just as in the past may find that when these are gone there will be none to replace them—and no service then will be much worse than a modified service today.

But even so, do good relations have to be sacrificed because a company is cooperating with the government in tire conservation? We don't think so, although we realize that there will be some people who can never be satisfied.

In New York City, and we suspect in other places as well, department stores have jointly appealed to their patrons to help them save rubber by not asking that parcels be delivered. And the response by the public was generous and immediate.

In fact, we believe that a utility can build good will out of the tire situation by asking the public to help it conserve rubber by being more patient on service calls. We believe that any reasonable city administration would unhesitating permit a less frequent street light inspection.

Members of the public understand the tire situation and will accept service call delays if frankly told. On the other hand, if the service is modified and nothing is said, then one cannot blame customers if they feel that the company is getting negligent.

## Capacitors as Transformers

CAPACITORS used as voltage dividers for measurement purposes and as couplers for carrier systems on high-tension lines are familiar and well established. They have also been used in a somewhat limited way as sources for the lighting energy for towers and air beacons. Abroad a battery of capacitors in series has been tapped for small low-voltage loads up to 10 or 15 kw.

While naturally a deterrent exists in the complexity of the computations to determine what value of capacitance is best to use for a given range of load in kw., what really makes for complexity is the potential variation in load power factor with all that means as to possible combinations of equivalent values of resistance, inductance and capacitance. The very thought of appropriate circle diagrams would make many a practical engineer hesitate, but have the opposite effect on the mathematical genius. So why not explore the possibilities in abstract? A start in this direction has been made by Silbermann in a January issue of *The Engineer*.

Capacitors have established themselves as reservoirs of compensating reactive power for improvement of voltage and power factor. They have even attained success in series arrangement. Meanwhile, they have acquired a wholesome reputation for portability, durability, low losses, ease of installation, high salvage and low maintenance. Perhaps they can even be developed for jobs for which transformers would be inept or too expensive, and particularly for small loads of fairly constant value. But this will only follow a careful development of the vector pattern for characteristic situations. It appears to be a field that warrants exploration both mathematical and experimental.

## Paper Work On Regional Pools

NORMALLY the interchange of surplus capacity between companies is properly conditioned in large measure by the economics of production and transmission to specified load centers. The setting up of increment costs and routine procedures results in a give-and-take during peacetime which aims to reduce costs of operation for the benefit of all concerned, including the public itself. While this objective is important during wartime, it is subordinate to the absolute necessity of keeping every plant producing war material of every sort supplied with electricity for maximum output of war material. Therefore economy becomes secondary for the duration, although the challenge to the engineer to reduce and indeed eliminate waste if possible is greater than ever.

Experience in the southeast during the drought of late fall and early winter bears this out. While haggling over fine-spun details of operation appears to be out the window, problems of this character call for exceptionally careful and comprehensive records of activities for future use.

Load dispatchers dealing with each other from day to day under peacetime conditions do not need to expand their paper work to the degree warranted when the country is at war. Complete records of operation under present conditions are important from many angles, not the least of which is governmental interest in system functioning. The reasons why particular steps have been taken should not be left out of logs and report summaries, and the same thing applies to costs incurred under emergency conditions which would not normally be experienced. Out of these complete records should come bases for future equitable allocation of expenses and revenues among interconnected systems, along with data bearing upon just compensation for situations which may or may not be subject to remuneration when readjustment days arrive.

Meanwhile, all the interests concerned in power interchange who work together primarily to help win the war so far as power can do it deserve high commendation for their unselfish comprehension of the crisis and its imperative needs.

## *Washington Comment*

*By GEORGE E. DOYING, Jr., Washington Correspondent*

# Will Congress Abdicate on New Federal Hydro?

MENTION the omnibus rivers and harbors bill pending before Congress and a controversy is almost immediately generated over the St. Lawrence, the Florida ship canal, the Tennessee-Tombigbee waterway — or what is your pet "pork project."

So much is this major piece of legislation identified with specific projects that an important legislative change in the basic rivers and harbors law in the same bill is being generally overlooked, although potentially more far-reaching than any single project. If Congress approves the proposed change it will be voting away its own right to decide when and whether electric power should be developed at any federal dam—it will be delegating authority to make this decision to the U. S. Army Engineers.

### *New Enabling Section*

In reporting the omnibus bill to the floor just four months ago today, the House committee completely rewrote Section 1 of the basic enabling law. Perhaps by accident, the phraseology of the new language appears on casual reading merely to incorporate into the law the provision permitting installation of penstocks which several years ago was written into the flood control statute. But, read it again!

The amended language reads:

". . . Provided, that penstocks or other similar facilities adapted to possible future use in the development of hydroelectric power shall be installed in any dam herein authorized when approved by the Secretary of War upon the recommendation of the Chief of Engineers and of the Federal Power Commission, and such recommendations shall be based upon consideration of the proper utilization and conservation in the public interest of the resources of the region and the Chief of Engineers is authorized in his discretion to construct powerhouses and install power machinery and appurtenances for the development by hydroelectric power at any dam heretofore or hereafter authorized by any act of Congress."

That's the bill as it awaits House consideration. It'll help a lot in trying to make sense out of that unpunctuated jumble of words to insert a semi-colon and the words, "Provided further," just ahead of the words, "Chief of Engineers is authorized." That makes it apparent that there really are two grants of authority in the amendment. One is phrased in the language previously used in the flood control statute, to extend to navigation dams the permissive authority to install penstocks even though Congress has not authorized the project for power development. This grant is limited to the projects "herein authorized," and the FPC must concur and the Secretary of War approve.

### *Full Authority*

The other portion of the new language flatly grants the Chief of Engineers authority to install power generating facilities in any government dam—those now built, those authorized but unbuilt, even those not yet authorized. No requirement for concurrence or approval of other agencies modifies the permission extended by these words.

To install penstocks in a dam authorized for a single purpose but which might some day be authorized by Congress for power development, the Engineers must have FPC acquiescence. To put power machinery in any dam at all the Engineers can act solely on their own judgment. That's the anomaly created by this proposed new language!

This sweeping grant of authority to the Engineers is deliberate. That much is certain from the committee report which interprets the amendment as "authorizing the Chief of Engineers to provide hydroelectric installations at any dam authorized by Congress." This, the committee calls "desirable and meritorious and in the public interest, especially at this time when prompt action along this line is essential in the defense program."

It appears that the amendment was born within the committee, presumably from the public power advocates, but the Army Engineers have indicated they aren't opposed to the idea of falling heir to this broad new authority.

### *Opportunities*

About a dozen dams now exist in which penstocks have been built but for which power development has not been authorized by Congress. Tygart Dam in West Virginia is one, and Nimrod, in Arkansas, and several of the chain of flood control dams in western Pennsylvania. There are scores of dams unbuilt which have congressional authorization as flood control or navigation projects, but no authorization for power development. Under the proposed amendment in the rivers and harbors bill, the Engineers could install power machinery in any or all of these projects at any time.

All they would need is the money, and this could be easy to get.

The omnibus bill, containing roughly a billion dollars worth of projects, was reported to the House floor November 21—sixteen days before Pearl Harbor. As soon as Chairman Mansfield and the House leadership can screw up enough courage to risk a vote the measure will get a rule bringing it up for debate—best guess is some time this spring.

The bill is certain to produce the sharpest fight in Congress since the war began. Opponents of the St. Lawrence project, well organized and vocal, will attempt to cut this scheme out of the bill. Other groups plan similar moves aimed at other controversial projects.

Up to now, however, there has been no challenge of the committee's proposal that Congress abdicate on the issue of hydro-electric development.

# NEWS OF THE WEEK

## New Regulation Concepts Urged by Court Minority

***Three "opinions" issue from natural gas case this week upholding 6½ percent return and elements of rate base — Three justices urge new basis***

In certiorari proceedings this week the Supreme Court upheld the order of the Federal Power Commission which, proceeding under the Natural Gas Act of 1938, prescribed a 6½ percent return in the case of the Natural Gas Pipeline Co. of America and Texama Natural Gas Co.

"The only question before us," declared the court, "is whether the rate prescribed by the commission is too low."

The decision stated that the Constitution does not bind rate-making bodies to "any single formula or combination of formulas" and that courts may not intervene unless due process is shown to be violated by arbitrary action.

In what was termed a "concurring" opinion, Justices Black, Douglas and Murphy declared that "the case started a new chapter in the regulation of utility rates" and argued for a new system of price fixing as a substitute for regulation on a fair return basis and against judicial review of commission decisions.

In a third opinion Justice Frankfurter stated that he wholly agreed with the opinion of the Chief Justice and the majority stated that Congress had given the power of judicial review to the courts over the "orders of the Federal Power Commission fixing 'just and reasonable' rates."

### *Dissenting Minority*

Popular attention was focussed on the dissenting opinion filed by the three justices which gave their interpretation of the majority opinion. In this dissenting opinion by the minority it was stated that "this case starts a new chapter in the regulation of utility rates. . . . as we read the opinion of the court, the commission is now freed from the compulsion of admitting evidence on reproduction cost or of giving any weight to that element of fair value."

The minority opinion then stated that "this is an appropriate occasion to lay the ghost of the 1898 decision (Smyth vs. Ames), which has haunted utility regulation." This was followed by the minority's opinion that the commission could now adopt "prudent investment as a rate base" and that "there could be no constitutional objection if the commission adhered to that formula and rejected all others."

### *Price-fixing Plan*

Another section of the minority's discussion of the majority opinion argued for a price-fixing plan in lieu of regulation establishing a fair return on the value of the property used and useful in rendering service. "Price fixing, like other social legislation," said this opinion, "may diminish the value of property."

Another argument advanced by the minority was that regardless of statutory provisions the decisions of the commission should not be subject to judicial review.

In his opinion Justice Frankfurter dismissed this contention with the statement that Congress had delegated the right to review to the judiciary and stated further that he wholly agreed, not with the minority expressions, but with the Chief Justice and the majority opinion in this case of the Power Commission versus the natural gas companies.

**McGRAW AWARD—Charles E. Swartzbaugh, president Swartzbaugh Manufacturing Co., makes presentation of the James H. McGraw Award Medal for Cooperation for 1940 and citation to the widow of Earl Whitehorne. See story in "Electrical World," March 14, page 5**

## Court Sets Utility Price

In a suit in Superior Court, Judge J. F. Stone has ruled that Skamania County (Wash.) can acquire the distribution facilities of the Northwestern Electric and Pacific Power & Light companies for the sum of $100,000. Judge Stone fixed the Northwestern price at $63,000 plus $5,000 severance charges; Pacific Power at $30,000 plus $2,000 severance damages.

# House Deals Two Blows to "Public Power Trust"

***Action saves $87,500,000 by canceling Bull Shoals and Table Rock power and flood control projects — Setback for AVA — Ellis, Olds and Rankin lose out***

The House of Representatives has dealt a crushing blow to the New Deal public power trust's efforts to advance its cause on the coattails of the war program.

In twin actions on the same day the House first refused to reinsert in the War Department civil functions appropriation bill funds to start a dam which the committee had left out, then voted to reject the committee's proposal to grant funds for starting a companion project.

***Saves $87,500,000***

The two actions resulted in elimination of funds for the projected Bull Shoals and Table Rock power and flood control dams on the White River. Together, the projects would cost $87,500,000 and would have an ultimate installed capacity of nearly one-half million kilowatts to provide the nucleus for an Arkansas Valley Authority public power domain.

Not only does the House's action hand the AVA scheme a sharp setback, but also it indicates that rough treatment is in store for the St. Lawrence power project, which is waiting to be called up for House debate. In both votes on the Arkansas projects the deciding issue was that the projects could be of no war value because of the time required to build them. First energy from either dam would not be available until late in 1944 and ultimate capacity could not be installed before the end of 1945. Even the proponents of St. Lawrence do not argue that power will be available before 1945.

The Congressional public power bloc made every effort to avoid the defeat. When it looked as though the projects were in trouble before the appropriations committee, a letter was rushed by special messenger to the Capitol from Chairman Leland Olds of the Federal Power Commission urging the necessity of the projects to the war program. On the House floor the effort to stem the tide was led by Congressmen Ellis, father of a pending AVA bill, and Rankin, for years chief spokesman for public power.

Leading the anti-public power forces were Congressmen Rich of Pennsylvania, Cochran and Ploeser of Missouri and Woodrum of Virginia, ranking Democrat on the appropriations committee.

The civil functions bill now awaits Senate action and the public power trust is expected to renew its fight to have the two AVA cornerstone projects reinserted in the hope of then getting them accepted by the House in a conference committee version of the measure.

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## Control Washington Outdoor Lighting

The nation's capital has new wartime regulations prohibiting the burning of lights visible from the outside except under approved arrangements permitting quick extinguishment.

Specifically, the regulations prescribe that it is unlawful to operate any privately controlled light which may be seen "in the open air" unless—

1.—During the time the light is lighted there is present a person responsible for and capable of turning it off on notice from defense authorities, or

2.—The person in charge of such light obtains from the precinct police captain certification that adequate arrangements have been made for complying with blackout regulations—such as an outside switch which air raid wardens can operate.

Special forms upon which to apply for certification of an unattended light have been drafted by the District of Columbia commissioners for those needing them.

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## Utility Sold Energy to Nine Co-ops in '41

The nine rural electrification co-operatives supplied power wholesale by the Arkansas Power & Light Co. bought 6,226,692 kw.-hr. for residential use during 1941, a recently compiled summary has disclosed.

"The co-operatives paid an average of 8.6 mills per kilowatt-hour," C. S. Lynch, executive vice-president, said. "For the entire year the co-operatives paid $52,542 for the power they purchased wholesale for residential purposes."

# NEWS BRIEFS

THE ANNUAL CONVENTION of the Edison Electric Institute, scheduled for the first week in June at Atlantic City, N. J., has been called off due to heavy demands being imposed by war upon executives and operating men in the utility industry.

FIVE IDAHO COUNTIES and Spokane County in Washington had a fifteen-minute test blackout covering an area of 10,405 miles. The city of Spokane remained ablaze as city civilian defense leaders said the blackout was "too short a time to permit a complete check of effectiveness by the wardens."

DURING A TEST BLACKOUT in Westchester County, N. Y., a skull operation proceeded in the White Plains Hospital with regular lighting behind blackout curtains.

APPLICATIONS FOR RATE INCREASES will be sought by Consolidated Edison of New York, Chairman Floyd Carlisle this week told stockholders clamoring for maintenance of common stock dividends and asking operating expense reductions. Stockholders were particularly critical of salaries, pensions and the number of vice-presidents, who total 27.

MEMPHIS STREET LIGHTING IMPROVEMENTS must be deferred indefinitely, WPB has told the city fathers in denying a request for priority on light fixtures "because of the necessity for conservation of power in your area."

UTAH POWER & LIGHT president George Gadsby reminded local civic clubs in Salt Lake that to date no plant or industry has been unable to locate in the intermountain area or northern Utah for the sole or controlling reason of inadequate power supply from utility companies.

DOWN IN TEXAS President John W. Carpenter of Texas Power & Light called for a meeting of municipal and public utility company leaders to form a common power pool for the duration.

BY NEXT OCTOBER, says Ontario Hydro-Electric Power Commission spokesman, electric signs and street lighting will be curtailed and householders will be asked to use electric heaters as infrequently as possible.

R. W. PETERSON, chairman of the Public Service Commission of Wisconsin, appeared recently before a congressional committee in Washington to oppose the proposed legislation which would set aside state regulations as to size and weight of motor vehicles which

are permitted to operate on public highways. Many states opposed the bill as being an encroachment on the jurisdiction of their state authority over matters of local concern. The bill is seen as removing from the control of local authorities the protection of state highways.

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# Turbine Allocations for Utilities Drop 290,000 Kw.

***New order M-76 further decreases turbine deliveries to utilities in 1942 to "around 2,000,000 kw." — Caused by Navy demands and material shortages***

Total capacity of turbo-generators scheduled for delivery from manufacturer's shops to utilities in 1942 has now dropped to "around 2,000,000 kw." from an original tentative allocation of 2,290,000 kw. (ELECTRICAL WORLD, January 25, 1942, page 5). Part of this decrease is due to increased allocation of manufacturing capacity to Navy requirements and part is due to the fact that inability to get materials will delay production.

***Coincides with M-76***

The revised tabulation of the 1942 output assigned to utilities coincides with issuance by the War Production Board of Priority Order M-76, putting land turbines on a formal allocation basis.

The order requires that manufacturers shall schedule production and make deliveries in accordance with specific directions from WPB, which means the Power Branch, which is administering the order. If it becomes impossible for any manufacturer to maintain the production schedule assigned for any reason, the order requires he continue to deliver generating units in accordance with the allocation schedule.

Effect of the order is to make obsolete priority ratings for turbines and to prevent a turbine rated, say, A-1-j for August delivery from interfering with a unit scheduled for July but rated only A-2. Under the priority rating system, if the manufacturer could not meet both dates, he would be obliged to fill the higher rated order. Under M-76 the manufacturer will fill the orders in the sequence directed by the Power Branch.

In setting up construction projects involving new generators, however, utilities still will apply for a project rating in order to obtain other needed materials.

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## REA Funds Wrongly Used, Moses Hints

Arkansas should be very proud of the fine job that REA co-operatives have done in bringing electricity to farmers, C. H. Moses, president of the Arkansas Power & Light Co., told directors of the Farmers' Electric Co-operative at a recent meeting.

"The National Rural Electrification Program was developed first for the joint purpose of creating employment and electrifying farms, and then became solely a farm electrification program," Mr. Moses said. "These original ideas were excellent and should be carried out," he continued.

"When funds intended for farm electrification are used for other purposes not intended in the rural electrification aims, it is the farmer who suffers, and now with copper and other materials so scarce, the farmer should insist that he be given the benefits he is entitled to. Building needless high-voltage transmission lines does the farmer no good."

Mr. Moses pointed out that the co-operatives that are buying power from the Arkansas Power & Light Co. are getting it about 3 mills cheaper than Harry Slattery, REA administrator, has said that co-operatives can generate their own power.

## RFC Finances New Ohio River Power Co.

A joint application of the Ohio Public Service Co. and the newly organized Ohio River Power Co. for the purchase of land and the erection of a new 50,000-kw. steam-generating station at Dilles Bottom, Belmont County, Ohio, has been placed under advisement of the state Utilities Commission.

Under provisions of the proposal, involving an expenditure of $8,000,000, already advanced by the Reconstruction Finance Corporation, the service company would sell land it owns to the new concern for a stated value of $379,840.

At the same time the new company would issue and sell to Ohio Public Service 5,000 shares of $100 par value common stock, with the proceeds used to pay for the cost of the land and to provide working capital.

If approved, the Ohio River Power Co. will sell power to Ohio Public Service and serve industries in northern and northeastern Ohio. The project will increase the present capacity of Ohio Public Service Power by 33 percent.

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## E. H. Will Elected Head of El Paso Electric Co.

Erwin H. Will, formerly general superintendent, lighting and transportation departments, El Paso Electric Co., El Paso, Tex., has been elected president of that utility to succeed Roy S. Nelson, who has recently assumed the duties of president of the Gulf States Utilities Co. (this issue, page 152).

**RED CROSS HELPERS—Girls from New England Power system companies join together at the Boston offices in a "knit-fest" for this great relief organization. Adele M. Hatton, president of the Boston Office Girls' Club, sits sixth from right, back row. Much of the work is done outside the office**

# Southeastern Engineers Discuss War Problems

***Service will be shorn of frills, say speakers at Raleigh meeting — Government jobs not utilizing facilities fully — New tires, recaps, women employees and outdoor lighting controls discussed***

How to maintain service in the face of rising loads and of growing inability to obtain materials, supplies and equipments was the common topic of papers and discussions at the meeting of the Southeastern Electric Exchange Engineeding and Operating Section at Raleigh, N. C., March 12 and 13. The titles of papers and subjects of discussions were various, but in all of them, implicit or stated, was the concern of all electric utility operators with the increasing difficulties of having more to do and less to do it with. The apparent consensus was that service would be maintained, service with the goldplating worn off, minus the frills and furbelows to which the users have been accustomed.

### *Underloaded Installations*

Outstanding paper of the meeting was that on "Meeting Increased Defense Loads on Distribution Systems in War-Time," by H. A. Enos, distribution engineer, American Gas & Electric Service Corp. An interesting point that came up several times in the discussion of this paper was a comparison of the actual or imminent overloading of utility distribution facilities with the apparently characteristic underloading of transformers, feeders and secondary copper in army cantonments and other government installations. One case cited was of a cantonment for which the utility was asked to provide 10,000 kw. This figure was reduced by utility engineers to 2,500 kw. and all of this has not been used.

The only electric utility vehicles for which there is any assurance of getting tires or even "recaps" are the trucks used for construction and maintenance of system and for appliance repair, said Randolph Whitfield, Georgia Power Co., in his paper on "Conservation of Automotive Equipment." A. H. McDowell, Jr., Virginia Electric & Power Co., foresaw a largely increased employment of women in utility engineering and operating departments in his paper dealing with war-time conservation of man-power. The paper by J. S. Spurgeon, Alabama Power Co., pursued the theme of conservation further with a broadly inclusive discussion of salvage and reuse of materials and equipments.

Lots of ingenious devices and methods have been thought up for blackout control of street and other outdoor lighting, said George A. Eddy, General Electric, and he described many of them, but about the best thing a utility can do in this matter is to secure the cooperation of load defense authorities in giving responsibility for that control into the hands of air raid wardens.

War-time changes in circuit interrupting requirements and developments to meet them were described by B. P. Baker, Westinghouse. In his paper on power factor testing of transformer insulation, J. B. Hodtum, Allis-Chalmers, disclosed a method for such testing which takes into account different physical arrangements of transformer windings.

A talk on problems of utility priorities and interpretation of rules and regulations affecting priorities, started by Charles F. Kells, War Production Board, in a morning session had to be continued in an afternoon discussion that seriously reduced attendance at the programmed meeting it paralleled. George Sutherland, utility coordinator of the Bureau of Industrial Conservation, predicted in the course of a brief talk that an order requiring electric utilities to report quantities of scrap copper on hand would soon be issued.

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## TVA Cautions Mayors on A.G.&E. Purchase

Mayors of six Kentucky cities have been notified that acquisition of Kentucky-Tennessee Light & Power Co. facilities, an affiliate of Associated Gas & Electric Co., without consultation with the Tennessee Valley Authority might prevent the federal agency from serving them. (Story on page 98)

W. L. Sturdevant, director of information for the agency, announced Gordon R. Clapp, TVA general manager, had telegraphed the mayors that:

"We feel it our responsibility to make clear to municipal officials and the public that we are not participating in these negotiations, that we have received no official notice of them and that acquisition of these facilities without consultation with TVA to co-ordinate TVA plans . . . may make it impossible for TVA for the indefinite future to serve this area."

The telegram was sent mayors of Bowling Green, Mayfield, Murray, Hopkinsville, Guthrie and Scottsville.

Mr. Clapp also stated that Kentucky newspapers had reported the Associated Gas & Electric Co., parent concern of the Kentucky-Tennessee, had designated certain bond houses to rep-

**PLANT PROTECTORS—Division engineer Theodore F. Breithaupt of Connecticut Light & Power and a state trooper interview an applicant for a post as plant policeman, later photographed and fingerprinted. Company property is protected 168 hours a week by rotating shifts, including guards and a number of linemen, service and trouble men distributed at strategic locations**

resent it in the possible sale of power facilities. . . . "and are attempting to persuade municipal officers that cities should, immediately and without popular referendum, buy these properties . . . on the basis of a negotiated price.

"Some press reports have referred to this as a step toward TVA power," he said. "This is not the fact. TVA has no interest in this transaction, if officials and the people of the area understand that it is not a move in the interests of securing TVA power and if they approve acquisition of properties. . . . on that basis."

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## Aluminum Needs May Solve Hetch Hetchy

War's need for aluminum appears likely to end the stalemate between the city of San Francisco and Secretary Ickes over distribution of Hetch Hetchy power. The War Production Board, it is understood, is recommending location of a two- or three-pot line aluminum plant near the city to use all of the city's generating capacity and more.

Thus the city is enabled to satisfy the requirement of the Raker Act prohibiting disposal of Hetch Hetchy energy for resale, while skirting the municipal ownership issue which Secretary Ickes, as enforcer of the Raker Act, has attempted for years to ram down the city's throat. Use of the power to serve a war industry obviously will satisfy Ickes, however, inasmuch as his real target always has been the Pacific Gas & Electric system, which now distributes Hetch Hetchy power over its lines for the city under a lease agreement.

The city has been enjoined from continuing the lease agreement and has until June 30 to find an alternate procedure. If the aluminum plant materializes another extension in the deadline for compliance probably will be granted.

The aluminum capacity being planned for San Francisco is part of the capacity originally tentatively listed for Chicago. Rest of that plant probably will be added to present and under-construction plants in the Northwest.

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## Authorize Seattle Bonds

Seattle City Council has granted a request of Light Superintendent E. R. Hoffman of the Municipal Light Department by passing an ordinance authorizing sale of $1,245,000 of City Light utility bonds to finance a program for enlargement of the system. The funds will be used to construct extensions to serve new customers and to enlarge present substations.

# National Membership for Operating Company Group

***Widespread geographical coverage characterizes Council of Electric Operating Companies — Will be operated on contributions, with no dues, and will serve the government rather than member companies***

Details, policy and procedure of the newly formed Council of Electric Operating Companies, organized to cooperate with the government in the war effort, were formally ratified at a meeting held in Chicago on March 13 of operating company executives. This was the second meeting of the entire group, the first meeting having been held two months earlier. Since the organization meeting early in January, considerable work had been accomplished by a committee and the meeting last week was for the purpose of reporting progress and securing ratification of actions taken.

### *Voluntary Contributions*

The Council of Electric Operating Companies will be composed of those operating companies that share in its cost. There will be no dues, only voluntary contributions. It is expected that the council will get under way with a membership that constitutes more than half the industry and is representative nationally.

Direction of the affairs of this body will be in the hands of the committee of the council (ELECTRICAL WORLD, March 14, page 7), at the head of which will be the council president, who will devote his entire time to this work. Tom P. Walker, who has resigned as president of the Gulf States Utilities Co., Beaumont, Tex., to take over this job on April 1, is establishing offices in Washington in the Homer Building at 13th and F Streets.

The committee of the council has been organized on a representative and area basis in order to secure as widespread geographical coverage as possible. It now numbers 27, but this number may be increased as council membership increases.

The council at present is operating under a set of resolutions without a constitution or by-laws. It has no officers other than the president and a temporary treasurer, Grover C. Neff, president Wisconsin Power & Light, Madison, Wis., who will receive member contributions. There are two committees, the committee of the council and a finance and membership committee. From time to time temporary committees may be appointed to assist the president with some particular problem arising out of the war.

The sole purpose of the council is to do whatever it can as an organized industry to cooperate with the government in winning the war. It was emphasized that council should take no part in any conflict between public and private ownership, that it should engage in no political activities. It was further stated that council was in no way to be a service organization for member companies. It could not be called on, for instance, to help in securing a specific priority for a member company.

Up to now, it was stated, the electric utility industry is the only important industry not represented in Washington. Council members felt that this was a handicap both to the industry and the government. Many things have been initiated by different government agencies without full knowledge of practical limitations that with the aid of a body such as the council could have been done in a way that would have brought quicker results for the government without duplication of effort or embarrassment to the industry. It is in matters such as these that the council states it hopes to be of major assistance to the government in winning the war.

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## House Slices $263,798 from REA Allotment

During its economy wave pruning of the Agricultural Department appropriation bill, the House sliced $263,798 from the administrative expenses for the Rural Electrification Administration in the fiscal year beginning July 1. This, plus a previous Budget Bureau cut of roughly $250,000 in REA's allotment, reduces the agency's administrative budget to $3,750,000 from $4,262,375 available this year.

The economy amendment was introduced by Representative Dirksen of Illinois. Another amendment, proposed by Congressman Faddis of Pennsylvania, to restate the provision in REA's basic law prohibiting loans for lines in areas receiving central station service was defeated by the House. House leaders argued that REA's hands should not be tied from undertaking a project that might be required by the war effort.

## War Problems Modify Code

Subcommittees of the National Fire Protection Association electrical committee, meeting in New York last week to consider proposed changes in National Electrical Code, made several recommendations to the parent committee intended to simplify handling of code matters arising from war conditions and to liberalize, for the duration, code restrictions regarding the use of CNX cable and bare neutral wiring. Recommendations will be submitted to electrical committee letter ballot action soon.

At a special joint meeting article subcommittees and available electrical committee members recommended that the electrical committee take no action on the 1943 edition of the National Electrical Code, but to plan for a supplement to the 1940 code to include only items bearing on war problems.

To speed the handling of special wartime code matters, a resolution was passed recommending establishment of wartime procedure for handling emergency matters through a small committee to represent the electric committee and publish rulings as war emergency recommendations of the electric committee, such recommendations to be effective for the war emergency only.

Article 250-300 and 310 subcommittees, acting jointly on the request of FHA, recommended to the electrical committee that CNX be recognized as a material and wiring method for the war duration for "defense emergency buildings." The CNX proposal, to be submitted for letter ballot to the electrical committee soon, goes along with the critical list of the WPB and FHA in specifying that outlet boxes, etc., should be nonconductive material approved for the purpose.

In reply to the WPB and FHA suggestion that article committee action be taken regarding recognition of bare neutral proposal will be submitted to the electric committee, suggesting that "on alternating-current interior wiring systems not over 208 volts to ground, slow-burning weatherproof or weatherproof wire be permitted for grounded neutral conductors" for the duration. The proposal is seen as meeting the need for conservation of rubber without full recognition of bare neutral wiring.

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## Plans New Power Line

Appalachian Electric Power Co. has sought the permission of the U. S. Engineer's Office, Huntington, W. Va., to construct an overhead power line across the Kanawha River, 300 feet upstream from the mouth of Two and Three-Quarter Mill Creek above St. Albans. The line will supplement service for the naval ordnance plant in South Charleston.

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## J. Emory Shute Dies

J. Emory Shute, a retired vice-president of the Pennsylvania Edison Co., Altoona, Pa., died on March 15 at his home in that city, in his seventy-sixth year. Mr. Shute retired from the company last year after being associated with it since its organization in 1910.

# MEETINGS

**Oklahoma Utilities Association** — Annual convenvention, Biltmore Hotel, Oklahoma City, Okla., March 23-24. Miss Kate A. Niblack, secretary, 625-626 Biltmore Hotel, Oklahoma City, Okla.

**American Society of Mechanical Engineers** — Spring meeting, Rice Hotel, Houston, Texas, March 23-25. C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

**Edison Electric Institute**—General power conference, Edgewater Beach Hotel, Chicago, Ill., March 24-26. Major H. S. Bennion, managing director, 420 Lexington Ave., New York, N. Y.

**Missouri Valley Electric Association**—Annual engineering conference, Hotel Continental, Kansas City, Mo., March 26-27. I. D. Pettegrew, director, 1527 Sharp Bldg., Lincoln, Neb.

**Midwest Power Conference** — Annual meeting, Palmer House, Chicago, Ill., April 9-10. Charles A. Nash, conference secretary, Illinois Institute of Technology, Chicago, Ill.

**Missouri Association of Public Utilities**—Annual convention, Jefferson Hotel, St. Louis, Mo., April 14-15, Jesse Blythe, assistant secretary, 101 West High St., Jefferson City, Mo.

**Electrochemical Society**—Spring convention, Hotel Hermitage, Nashville, Tenn., April 15-18. Colin G. Fink, secretary, Columbia University, 3000 Broadway, New York, N. Y.

**Southeastern Electric Exchange**—Annual conference, Edgewater Gulf Hotel, Edgewater Park, Miss., April 16-17. J. W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta, Ga.

**Northwest Electric Light and Power Association**—Engineering and operating section, Olympic Hotel, Seattle, Wash., April 23-24. Berkeley Snow, executive secretary, 418 Spalding Bldg., Portland, Ore.

**Maryland Utilities Association** — Spring meeting, Lord Baltimore Hotel, Baltimore, Md., April 24. Wilson Cook, secretary, Potomac Edison Company Bldg., Frederick, Md.

**Association of Iron and Steel Engineers**—Spring conference, Royal Connaught Hotel, Hamilton, Ontario, Canada, April 27-28. Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

**Chamber of Commerce of the United States** — Annual meeting, Washington, D. C., April 27-30.

**American Institute of Electrical Engineers** — North Eastern District, Schenectady, N. Y., April 29-May 1; summer meeting, Chicago, Ill., June 22-26. H. H. Henline, national secretary, 33 West 39th St., New York, N. Y.

**National Fire Protection Association** — Annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., May 11-15. Robert S. Moulton, technical secretary, 60 Batterymarch St., Boston, Mass.

**National Metal Trades Association**—Annual convention, Biltmore Hotel, New York, N. Y., May 19-20. Harry S. Flynn, secretary, 122 S. Michigan Ave., Chicago, Ill.

**Pacific Coast Electrical Association**—Annual convention, Fairmont Hotel, San Francisco, Calif., May 21-22. Victor W. Hartley, managing director, Edison Bldg., Los Angeles, Calif.

**National Association of Purchasing Agents**—Annual convention, Waldorf-Astoria Hotel, New York, N. Y., May 25-27. G. A. Renard, executive secretary-treasurer, 11 Park Place, New York, N. Y.

**American Society for Testing Materials**—Annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 22-26. R. E. Hess, assistant secretary, 260 S. Broad St., Philadelphia, Pa.

## Cities May Buy Up Associated Property

Receivership trustees of the Associated Gas & Electric System are willing to consider sale of Kentucky properties of the Kentucky-Tennessee Light & Power Company, A.G.&E. subsidiary, at a figure around $8,000,000, city officials at Bowling Green, Ky., have been told.

The report was made by Marion H. Cardwell and Robert B. McDowell, Louisville investment firm representatives, who said their companies (J. J. B. Hilliard & Sons and Blyth & Co.) have been designated by Associated trustees to represent them in negotiations leading to possible sale of the Kentucky properties.

The sale figure would include Frankfort water and electric properties, Bowling Green electric and gas, Scottsville electric, Russellville electric and gas, Mayfield electric and water, Murray electric and water; five Ohio River properties — Irvington, Hawesville, Cloverport, Hardinsburg and Lewisport, and other smaller properties over the state, including Brownsville, Smiths Grove, Cadiz, Elkton, Guthrie, Lebanon Junction, Bloomfield, Taylorsville, Irvine, Ravenna and Beattyville.

The investment men conferred here with a special Common Council committee named to investigate the possible purchase by Bowling Green of Kentucky-Tennessee properties in this city.

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## A.S.A. Issues List of 500 Standards

Nearly five hundred American standards are listed by the American Standards Association in its new summary of "American Standards for 1942."

There is a separate heading for American Defense Emergency Standards, developed specifically for defense purposes.

Copies may be secured gratis by writing to American Standards Association, 29 West 39th Street, New York.

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## Illinois Utility Cited

Federal Power Commission has directed the Central Illinois Public Service Co. to show cause at a public hearing on March 23 why the commission should not require the company to submit reclassification of accounts and original cost studies in accordance with the Uniform System of Accounts. The order provides that the Illinois Commerce Commission may participate in the hearing.

## Output Continues Seasonal Decline

The amount of electrical energy distributed by the electric light and power industry for the week ended Saturday, March 14, was 3,357,444,000 kw.-hr., according to the Edison Electric Institute, a decline of 34,700,000 kw.-hr., which again, as was stated last week, follows the seasonal pattern of 1940, 1939 and previous years.

The relatively high level of output last March contributes to the low percentage increase figure of 12.5 registered for this week. Without the "bulge" in the 1941 line, increase in output would be in the normal 14-16 percent zone.

There was no unusual change in the percentage increases of the geographic divisions except that the Pacific Coast area hit new high levels.

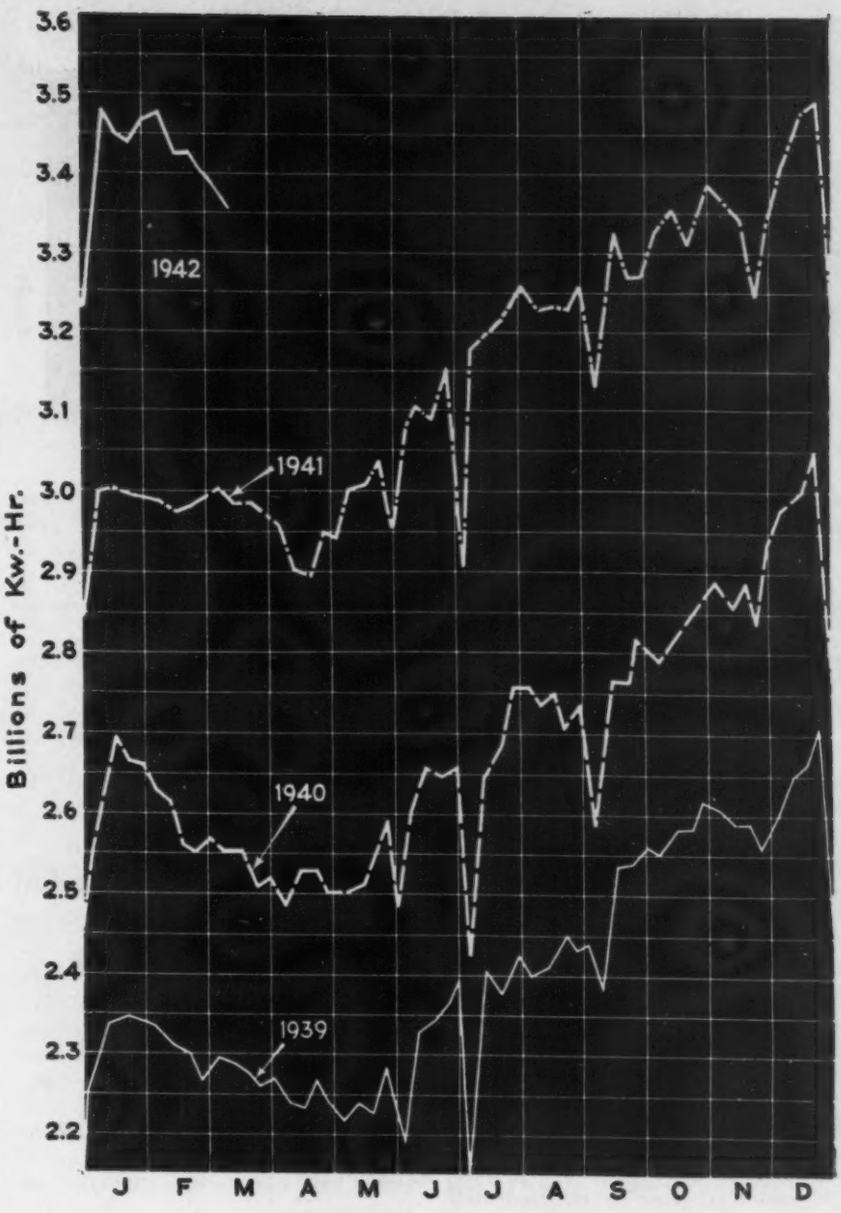
**Weekly Output, Millions Kw-Hr.**

| 1942 | | 1941 | | 1940 | |
|---|---|---|---|---|---|
| Mar. 14 | 3,357 | Mar. 15 | 2,984 | Mar. 16 | 2,550 |
| Mar. 7 | 3,392 | Mar. 8 | 3,005 | Mar. 9 | 2,553 |
| Feb. 28 | 3,410 | Mar. 1 | 2,993 | Mar. 2 | 2,568 |
| Feb. 21 | 3,424 | Feb. 22 | 2,986 | Feb. 24 | 2,547 |
| Feb. 14 | 3,422† | Feb. 15 | 2,976 | Feb. 17 | 2,565 |
| Feb. 7 | 3,475 | Feb. 8 | 2,989 | Feb. 10 | 2,616 |
| Jan. 31 | 3,468 | Feb. 1 | 2,994 | Feb. 3 | 2,633 |
| Jan. 24 | 3,440 | Jan. 25 | 2,996 | Jan. 27 | 2,661 |
| Jan. 17 | 3,450 | Jan. 18 | 3,013 | Jan. 20 | 2,674 |
| Jan. 10 | 3,473* | Jan. 11 | 3,002 | Jan. 13 | 2,688 |

**Percent Change from Previous Year**

| | Week Ending | | |
|---|---|---|---|
| | Mar. 14 | Mar. 7 | Feb. 28 |
| New England | +10.7 | +13.5 | +13.1 |
| Mid-Atlantic | + 8.3 | + 8.9 | + 9.5 |
| Central Industrial | + 9.9 | +11.0 | +12.9 |
| West Central | +11.6 | +12.1 | +13.1 |
| Southern States | +12.6 | +12.8 | +14.5 |
| Rocky Mountain | +13.2 | +15.2 | +17.3 |
| Pacific Coast | +29.1 | +25.2 | +23.4 |
| Total United States | +12.5 | +12.9 | +13.9 |

* Revised. † War-time began.




## P. G. & E. Valuation Hearings Opened

W. G. Vincent, vice-president and executive engineer of the Pacific Gas & Electric Co., testified before the California Railroad Commission recently that he had placed fundamental reliance on probable earnings in arriving at a market value on the company's electric distribution system in the Sacramento Municipal Utility District. Mr. Vincent maintained that the system had an over-all market worth of about $18,275,000, including $12,500,000 as the historical value of the properties.

Stephen W. Downey, attorney for the district, sought to draw out Mr. Vincent on his views regarding public ownership, but the questions were overruled by Commissioner Carl C. Baker, after Chaffee Hall, attorney for the company, had objected on the ground "political philosophy has no bearing on valuation." Mr. Vincent conceded he believes severing the Sacramento area from the remainder of the P.G.&E. system would be "uneconomical and anti-social." Lester S. Ready, consulting engineer, told the commission he believes that Pacific Gas should be compensated to the extent of no more than $9,963,000.

The commission's hearings are to determine a valuation on the company's system within the district in connection with condemnation proceedings.

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## Stream Flow Conditions

The month of February was the first since July, 1941, and the second since December, 1940, when there were no areas of deficient stream flow in the United States, according to the monthly report submitted to Secretary of the Interior Harold L. Ickes by the Geological Survey.

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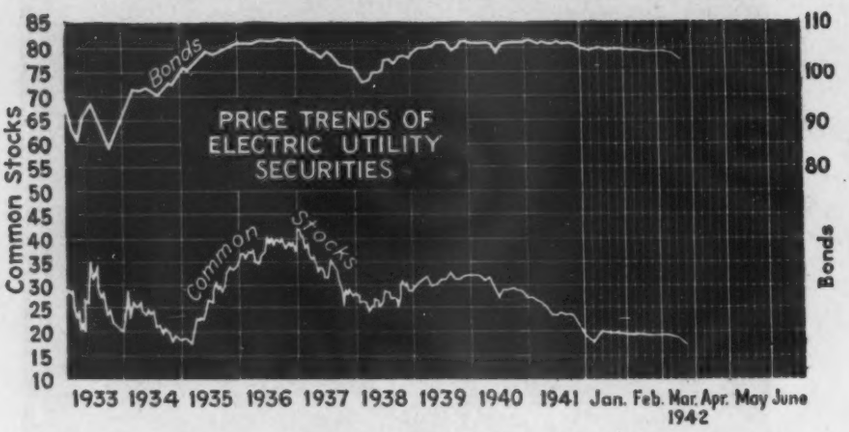
## New Hydro Unit in Mexico

Announcement has been made that a new hydro-electric plant is being built at Ixtapantongo, State of Mexico, by the government. The plant is scheduled to have a capacity of 93,000 kva., and in addition to providing energy for the rural zone where it is being built it will also serve Mexico City, through a line extending over the 50 miles from the plant to the capital. The Government Commission of Electricity hopes to see the American equipment in operation before the end of this year.

## Stock and Bond Prices Drop Sharply


PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
Bonds
Common Stocks
Common Stocks
Bonds
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
1933 1934 1935 1936 1937 1938 1939 1940 1941 Jan. Feb. Mar. Apr. May June 1942

**Prices of utility securities went downward last week, accelerating the trend of the past several months. "Electrical World" stock index dropped to 17.7 from 18.4; last year, 25.9. Bonds went to 102.4 from 103.5; last year, 105.9.**

## Dual Fuel for Manchester Plant

To insure against future interruption or curtailment of fuel oil supplies the Public Service Co. of New Hampshire is adapting its 20,000-kw. (present rating) Manchester steam plant for full-load operation with either pulverized coal or oil. It is expected that the changeover will be completed by midsummer of this year, on account of delays in equipment deliveries due to the war.

J. Brodie Smith, vice-president, states that in 1941 the company used 450,655 bbl. of fuel oil (18,927,512 gal.), or the equivalent of 1,900 railroad tank cars of the largest size. All of this oil was waterborne by ocean-going tankers from Gulf ports to the company's storage tanks at tidewater, and then transported overland as required to inland stations. There is a substantial price advantage in being able to receive full cargoes at tidewater, but should a change be necessary by shortage of tankers, the company is equipped to receive all-rail shipments at all steam plants. At present the company's normal use of fuel oil is at the rate of 55 tank cars per week.

It is probable that delivery cannot be made on the 10,000-kw. G.E. steam turbo-generator ordered last July for 1942 until 1943 or 1944, under prevailing conditions. Preliminary figures for 1941 show an output of 392,048,408 kw.-hr., a gain of 14.9 percent over 1940. Gross revenue rose to $7,643,741, or 11.8 percent; net income went up to $1,432,485, or 15.9 percent, and appliance sales reached $875,141, a gain of 47.7 percent. Energy output continues its upward trend. The recent drought increased sales to industrial customers whose own water powers were deficient, and war-time activities accounted for the major part of the industrial output increase in 1941.

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## Will Expand Bonneville Longview Substation

A total of approximately $5,697,000 will be expended in developing the Longview, Wash., substation as a major point in the Bonneville-Grand Coulee transmission network, Assistant Bonneville Administrator U. J. Gendron has announced. Allocation of $4,261,000 has been approved for construction of 230,000-volt facilities at the substation. A previous allocation of $1,436,300 covers cost of 115,000-volt installations.

Additions scheduled for completion this summer will include transformer and terminal facilities for both 115,000-volt and 230,000-volt service. An additional $556,000 has been allocated for construction of transmission lines to the substation.

## Utility Reports

| | Net Income 1942 | 1941 |
|---|---|---|
| *Alabama Power | $3,406,885 | $3,122,675 |
| *Georgia Power | 5,324,031 | 4,751,194 |
| *Kansas City Pwr. & Lt. | 3,317,883 | 3,720,776 |
| *Pennsylvania Power | 838,319 | 825,457 |
| *South Carolina Power | 458,044 | 406,331 |
| | **1941** | **1940** |
| †Derby Gas & Electric and subs | 310,553 | 208,543 |
| †Duke Power | 5,753,196 | 5,997,101 |
| †Louisiana Power & Light | 1,198,750 | 1,007,400 |
| †Mississippi Power & Light | 479,005 | 416,158 |
| †Philadelphia Electric and subs | 18,692,241 | 22,115,629 |
| †San Antonio Public Service | 1,048,299 | 1,090,580 |
| †Southern Calif. Edison | 12,533,341 | 12,179,772 |
| †Wisconsin Electric Pwr. | 2,851,335 | 2,764,434 |

* Twelve months ended January 31.
† Twelve months ended December 31.

# PRIORITIES AND PRICE SHORTS

COMPANIES OPERATING under the Production Requirements Plan are permitted to use ratings assigned by other certificates to obtain material not regularly carried in stock under an amendment to Order P-90. Previously, concerns using PRP have been strictly limited to use of the ratings granted them on the PRP application, except by special authorization.

A-10 PRIORITY ASSISTANCE has been made available for the maintenance of refrigerating equipment in stores and restaurants. Rating is applied under terms of Priorities Order P-100, the general repair and maintenance procedure.

PRODUCTION OF WASHING MACHINES is about over for the duration. The War Production Board, after collaboration with the industry advisory committee, has fixed April 15 as the deadline for larger manufacturers and May 15 for the smaller ones. "Large" manufacturers are those in Classes A and B in the production quota orders. This industry was the first to begin conversion to war work on an industry-wide basis.

THE WAR PRODUCTION BOARD has issued a report on the relative scarcity of a hundred or so raw materials. They're classified in three groups—those "not generally available" for civilian needs, those "not as critically limited" and those available "in some quantities for other than strictly war purposes." All metals are in Class 1. The whole list is available in Release WPB 506.

STRIKING DIRECTLY AT PROFITEERING, Price Administrator Henderson has issued a maximum price schedule on used passenger car and truck tires. Prices are fixed at four levels, by the amount of tread left and Henderson emphasizes that his schedule is one of maximum prices, pointing out that many a tire technically eligible for one class price isn't worth that much.

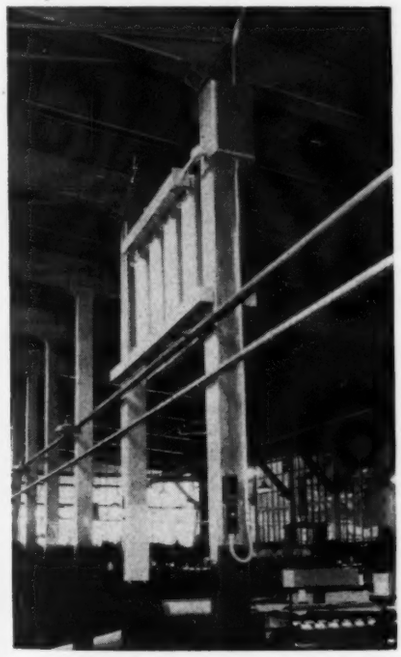
GASOLINE RATIONING, for the present, is to be at the service station level, just as it was in the ill-fated experiment of last year. Ickes, as oil coordinator, will administer the order under authority delegated by Nelson and formalized by a priorities limitation order—L-70. Commercial vehicles (those classified so by law) are entitled to "minimum necessary requirements" of gas from a supplier (oil company, not a service station) upon presentation of a prescribed form.

# HOW DESIGN . . . CONSTRUCT OPERATE MAINTAIN

## Industrial Power

### Compact Control for Capacitors

In an Eastern industrial plant located in an active defense area an Electric Machinery Company capaci-



**MILL construction facilitated mounting of capacitor bank**

tor bank typifying a distributed installation of such units for improving internal circuits conditions was placed between two adjacent timber columns on 6x6-in. horizontal stringers bolted to the columns as shown, clearing productive space. On-and-off control cabinet and push-button units were likewise mounted with column supports and all connections run in rigid conduit to minimize chances of mechanical injury and fire hazards. The installation has the great advantage of high flexibility, and in case loads shift materially as a result of war activities it is a matter of but a few hours to dismantle the unit and transfer it to a location where corrective effects are more essential.

## Stores

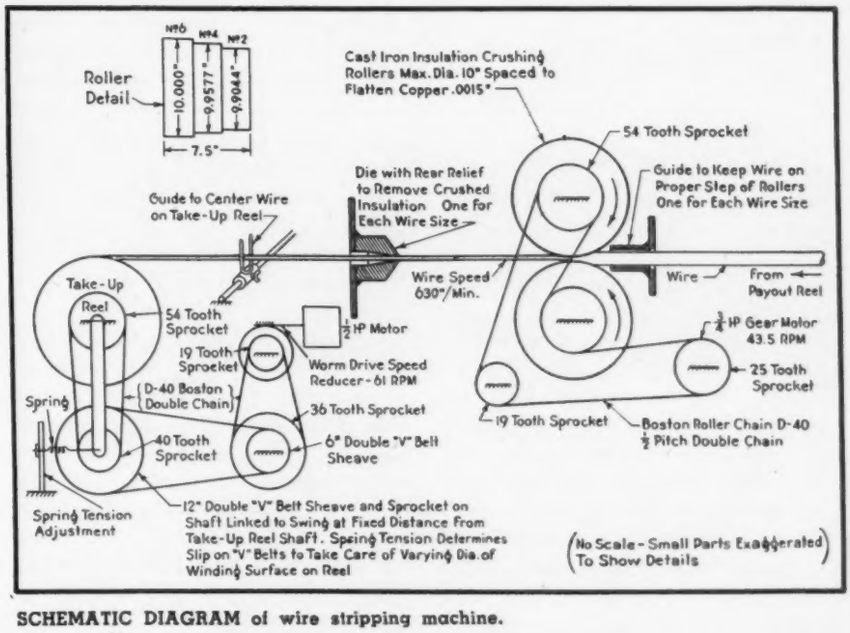
### Stripping Machine Reclaims Wire

**By J. F. EMERY**
Assistant Superintendent of Distribution
Idaho Power Company, Boise

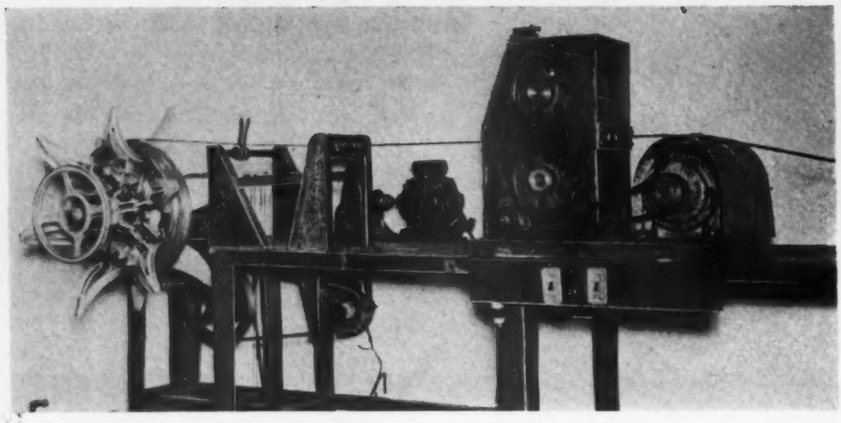
As a result of many large reconstruction jobs the Idaho Power Company found itself with an abundance of ragged weatherproof wire on hand. As this was the same size of conductor as was in large demand, it appeared inconsistent to sell this old wire for junk and purchase new bare wire of the same size. Accordingly, a stripping machine was devised to remove the old, ragged weatherproof insulation and make the wire suitable for reuse.

The schematic diagram illustrates the general features and principles of operation of the machine. The accompanying illustration shows the machine in its final form. The guard over the drive chain has been removed to show details of construction.

Rolls operate at a surface speed of 630 in., or 52.5 ft. per minute. As frequent stops must be made to cut out old splices in the wire and make new splices, the machine will not be in operation more than one-


Roller Detail
№6
№4
№2
10.000"
9.9577"
9.9044"
7.5"
Cast Iron Insulation Crushing Rollers Max. Dia. 10" Spaced to Flatten Copper .0015"
54 Tooth Sprocket
Guide to Keep Wire on Proper Step of Rollers One for Each Wire Size
Die with Rear Relief to Remove Crushed Insulation One for Each Wire Size
Guide to Center Wire on Take-Up Reel
Wire Speed 630"/Min.
Wire
From Payout Reel
Take-Up Reel
54 Tooth Sprocket
19 Tooth Sprocket
½ HP Motor
Worm Drive Speed Reducer - 61 RPM
¾ HP Gear Motor 43.5 RPM
25 Tooth Sprocket
D-40 Boston Double Chain
Spring
36 Tooth Sprocket
40 Tooth Sprocket
6" Double "V" Belt Sheave
19 Tooth Sprocket
Boston Roller Chain D-40 ½ Pitch Double Chain
Spring Tension Adjustment
12" Double "V" Belt Sheave and Sprocket on Shaft Linked to Swing at Fixed Distance from Take-Up Reel Shaft. Spring Tension Determines Slip on "V" Belts to Take Care of Varying Dia. of Winding Surface on Reel
(No Scale - Small Parts Exaggerated To Show Details)

**SCHEMATIC DIAGRAM of wire stripping machine.**



**WIRE STRIPPER in operation**

half the time. Net average output then is:

$52.5 \times 60 \times 0.5 = 1.575$ per hour

The savings resulting from reconditioning various sizes of wire are as follows:

*No. 6 Copper*

$\frac{1,575}{1,000} \times 79 = 124.2$ lb. per hour

Junk copper $0.0825 per lb.
Stripped copper 0.19 per lb.
Increased value with reconditioning: $0.19—$0.0825 = $0.1075 per lb.
124.2×0.1075 = $13.38 per hour
Labor at $1.10 per hour = $1.10
Splicing sleeves at 12.5 per hour at $0.06 = $0.75 — 1.85
$11.53 per hour

Net saving per pound of copper reconditioned = $\frac{\$11.53}{124.2} = \$0.0928$

*No. 4 Copper*

$\frac{1,575}{1,000} \times 126 = 198.5$ lb. per hour

198.5×0.1075 = $21.30 per hour
Labor at $1.10 per hour = $1.10
Splicing sleeves at 12.5 per hour at $0.08 = $1.00 — 2.10
$19.20 per hour

*No. 2 Copper*

$\frac{1,575}{1,000} \times 201 = 317.0$ lb. per hour

317×0.1075 = $34.10 per hour
Labor at $1.10 per hour = $1.10
Splicing sleeves at 12.5 per hour at $0.10 = $1.25 — 2.35
$31.75 per hour

During the last half of 1941 approximately 22,000 lb. of No. 6 wire was reconditioned by this machine. The estimated savings from this operation are thus $2,041.

This machine could be duplicated for approximately $600, and in case a company has a substantial junk pile it could be built for considerably less. Even on the basis of building the machine with all new parts, if a company is removing any appreciable amount of old weatherproof wire and has use for bare copper of the same size, the machine will show very substantial economies.

## Meters

### Remove Jewels When Meters are Tested

Until recently Jersey Central Power & Light Company's meter test men inspected meter jewels in the field, removing those with apparent and detectable flaws.

The present practice is to remove all jewels when the meters are tested and send them back to the meter repair shop. There they are cleaned in a jewel cleaning machine and examined under a microscope. When the meters are tested, the steel pivots and ball bearings are also removed and replaced. These parts, together with meter registers and other elements, are cleaned in a machine obtained from the Eastern Specialty Company.

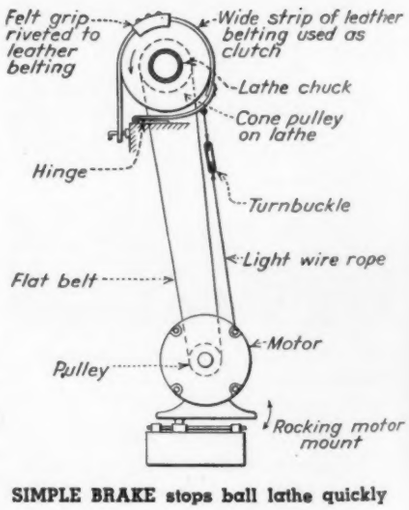
As a result of this change in meter test procedure it is believed that jewel life and meter accuracy have been substantially lengthened and improved. Since this procedure was inaugurated it has been found, too, that synthetic jewels have proved superior to the natural stones originally used in all meters. Periodic tests of meters are made at intervals ranging from once every five years for regular size meters to once every three months for large industrial power installations.

## Industrial Power

### Quick-Stop Device for Light Lathe

Hand turning of solid-ivory billiard balls at the Brunswick-Balke-Collender Company, Muskegon, Mich., is a highly skilled manual art performed on a light lathe equipped with a special ball-holding chuck. Quick starting and stopping of the lathe is essential to accurate turning. For this purpose an ingenious friction "clutch-brake" is being used successfully.

**CLUTCH-BRAKE in use**




**SIMPLE BRAKE stops ball lathe quickly**

A strap, seen under the operator's hand in the picture, is looped over the large-diameter step of the lathe's cone pulley and connected by a wire rope to the fractional-horsepower driving motor, arranged on a rocking mount. By pulling lightly on the brake belt

# How feeder regulators help meet wartime power needs . . . with SAVINGS in COPPER and MAN-HOURS

THERE WAS a time when power companies installed feeder-voltage regulators primarily to provide a superior brand of service most economically. That time is past!

Today—because adequate voltage is absolutely essential to full production and because of the need for conserving materials and man-hours—regulators are almost a necessity. Regulators make it possible to supply more load over existing feeders without allowing voltage to drop to dangerous levels. Every time regulators can be used to bolster faltering voltage, the rebuilding of a feeder (or the installation of a new one) is avoided. Tons of copper and hundreds of man-hours are saved.

### How Much Extra Load?

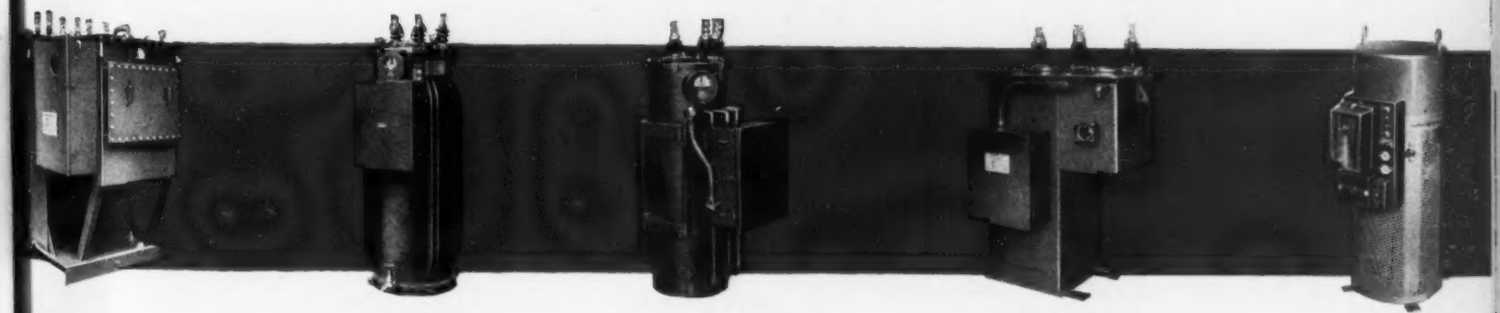
An example typical of the conditions in many industrial areas today: Assume a 3,000-kva, 0.75-pf load distributed over the last four miles of an 11-mile, 13.8-kv, 4-wire feeder of No. 1 conductor. It is desired to add 1,000 kva of load in the load area. With 5 per cent of the regulation at the substation available for correcting line drop, full-load voltage drop at the end of the line is 9 per cent. If the new load is added without provision for voltage regulation, the voltage drop becomes 13½ per cent at the end of the line—too much to keep lighting at adequate levels, too much to assure maximum output from motors. By the installation of an additional regulator on the feeder, the 1,000 kva of new load can be carried with the original voltage drop of 9 per cent.

### How Much Saving in Material?

Of course, correct voltage level could be obtained by rebuilding the feeder and replacing the No. 1 conductor with No. 4/0. However, the new conductor would require ***46 tons more*** copper. Since the regulator would require only 1.2 tons of copper, the net saving of this vital material would be almost 45 tons—90,000 pounds.

In addition, 350 man-hours of labor would be saved because of the shorter time required to build and install the regulator, compared with manufacture and installation of new conductor.

*General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.*



THREE-PHASE STEP | SINGLE-PHASE INDUCTION | SINGLE-PHASE INDUCTION | SINGLE-PHASE STEP | AIR-COOLED INDUCTION

**REGULATORS FOR EVERY TYPE OF FEEDER • • OBTAINABLE PROMPTLY**

GENERAL ELECTRIC feeder-voltage regulators are obtainable—promptly—for circuits from 120 to 69,000 volts. Induction and step types—oil-filled, Pyranol, and air-cooled—permit choice of a regulator *exactly* suited to the requirements. For complete information ask a G-E representative for Catalog GEA-2762B and Publication GEA-3779. General Electric, Schenectady, N. Y.

# GENERAL ELECTRIC

404-28-5400

in the direction of rotation the operator lifts the motor and slacks off the driving belt, causing it to slip. With driving torque removed, friction of the strap "clutch-brake" on the cone pulley stops the lathe quickly.

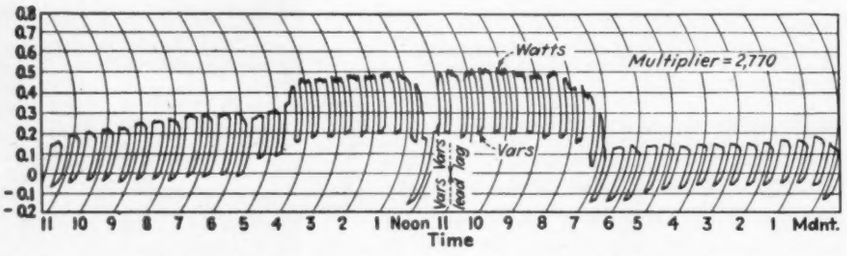
## Service Analysis

# Var-Wattmeter Aids Capacitor Studies

In making power factor and load studies of distribution circuits to determine the best locations for the installation of shunt condensers, engineers of the Central Illinois Electric & Gas Company, Rockford, Ill., developed a relay panel which, when used with a recording wattmeter, gives an alternate record of watts and volt-amperes reactive, on a single chart. The board is wired so that it may be used on both three-phase, three-wire delta circuits and four-wire, three-phase wye circuits.

A time switch arrangement in the circuit shown switches meter connections at intervals so that the chart records watts load on the circuit for a period of twenty minutes and then reactive volt-amperes for a period of ten minutes, returning at the end of that interval to the recording of watts for another twenty-minute period and so on.

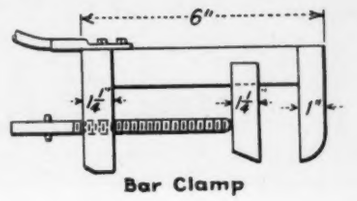
The recording wattmeter used with the relay board is a low-current-burden Esterline-Angus instrument suitable for either a.c. or d.c. recording when equipped with the proper shunts. This type of instrument made possible the use of an inexpensive auto-transformer of low burden capacity.



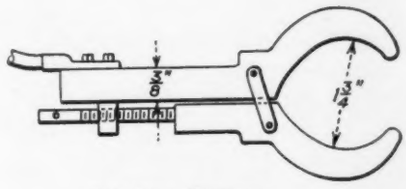

**SINGLE CHART** gives alternate record of watts and vars on distribution circuit to guide capacitor installation. Chart shows watts for twenty minutes, vars for ten

## Substations

# Temporary Connections Solidly Made

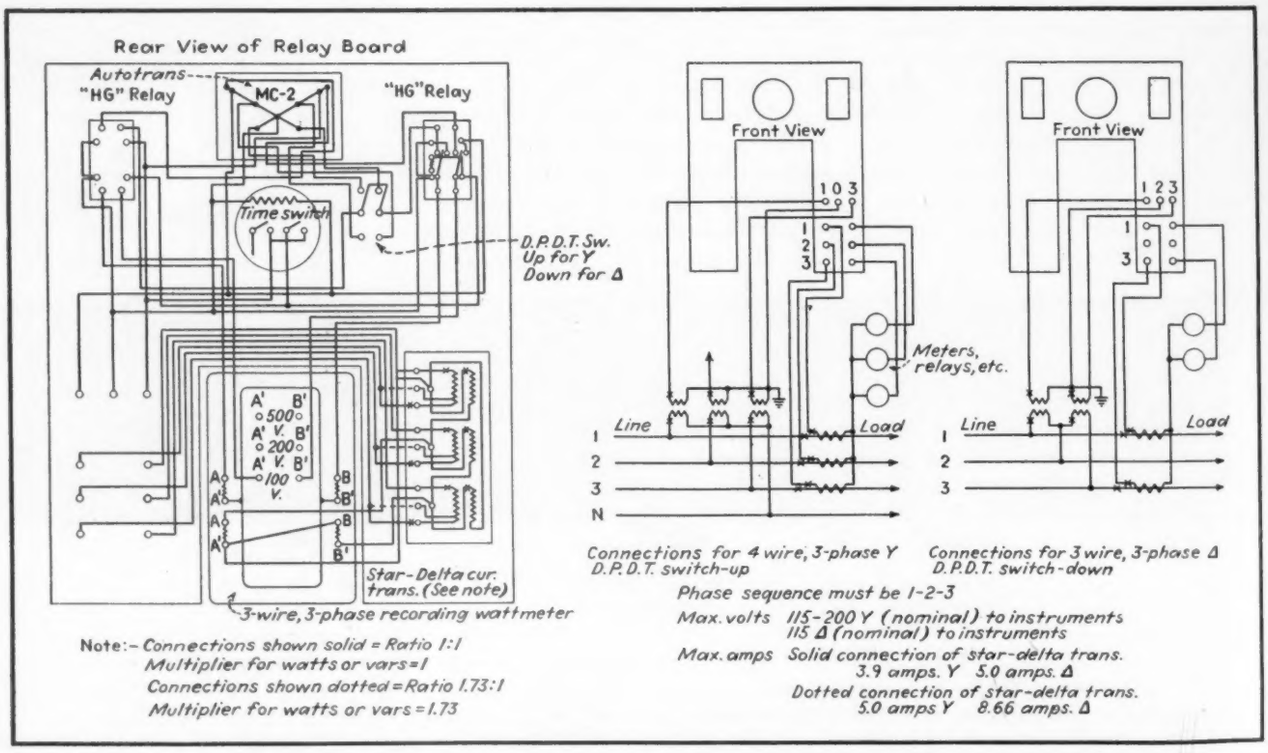



Bar Clamp




Tubular Clamp

Problem of making temporary, but solid, cable connections to tubular and bar-type conductors has been simplified at the Nebraska Power Company plant with two ingenious adjustable clamps which are attached to the end of temporary cables. Both of the clamps, details of which are shown in the accompanying sketches, are attached to the conductor with a "hot" stick.




**RELAY BOARD** switches connection of recording wattmeter automatically to produce record of watts and vars on same chart

# TO REDUCE YOUR STOCK REQUIREMENTS

WHEN you use G-E fuse cutouts, smaller stocks adequately take care of your requirements. Why? Because each G-E cutout can do any one of three different jobs. You can convert a G-E cutout from a single-element unit to a reclosing unit, or to a disconnect, simply by changing the door.

For example, suppose you wish to reduce outages by converting some single-element cutouts to reclosing cutouts. Just swap doors—they contain the complete mechanisms. With the aid of the new G-E jumper stick, a lineman can do the complete job in a few minutes.

To convert to disconnects, just change the doors again. This gives you a new kind of disconnect, too, with an indicating feature for easy spotting, and a can't-be-lost blade which is isolated to protect the lineman.

Look over this five-part combination—it answers the problem of how to get along with reduced stocks.

This 50-ampere cutout will take care of 80 per cent of all your distribution-cutout requirements. And we also have a similar 100-ampere line to take care of the other 20 per cent.

Write for Bulletin GEA-3448. General Electric Co., Schenectady, New York.

*General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.*

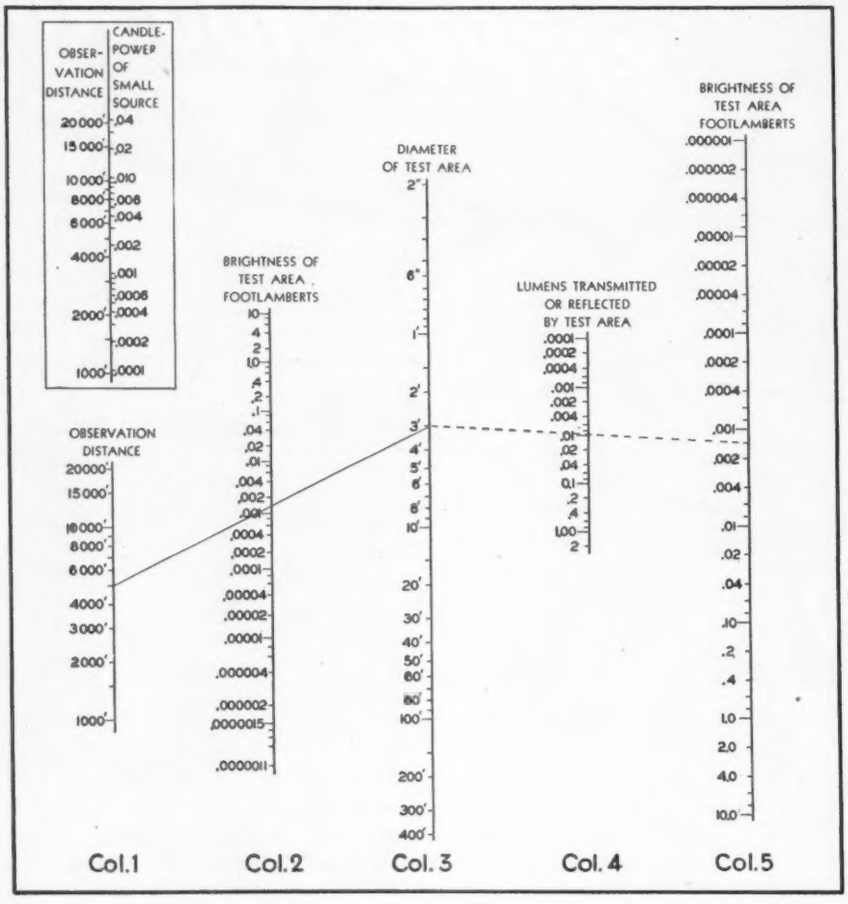
**GENERAL ELECTRIC**

4H6-9-5224

# BLACKOUT LIGHTING CHART

**Minimum Perceptible Brightness — Diffuse Area on Dark Field**

**Applicable Only to "White" Light — Fundamental Relationships Based on Laboratory Studies**




## Example for Use of Chart

**Given:**

Observation distance—5,000 ft.
Area under consideration—3 ft. in diameter
Area reflection factor—30 percent

**Determine:**

*1. Threshold value of brightness of a circular area from an observation distance.*

Draw a straight line connecting the distance of 5,000 ft. on Col. 1 and area diameter of 3 ft. on Col. 3, then at intersection of Col. 2 read the area brightness of 0.0014 foot-lamberts.

*2. Threshold value of lumens diffusely emitted by the area.*

Draw a straight line connecting area diameter of 3 ft. on Col. 3 and area brightness of 0.0014 foot-lamberts on Col. 5, then at intersection of Col. 4 read 0.01 lumens transmitted by the area.

*3. Incident foot-candles.*

Divide 0.0014 foot-lamberts found in step (1) by the reflection factor of the area under consideration or 30 percent, which equals 0.0046 foot-candles.

*4. Incident lumens.*

Divide 0.01 lumens found in step (2) by the reflection factor of 30 percent, which equals 0.033 lumens.

*5. Threshold candle-power of a small source at different distances.*

Read directly from the column in the box at the upper left of the chart.

*Lighting*

To estimate the least amount of "white" light that can be seen under various conditions data have been provided to assist lighting engineers and others concerned with blackout lighting. The accompanying chart was developed at the Nela Park laboratories of the General Electric Company. The chart permits of rapid determination of the relations between observation distance, size of the illuminated or luminous area, threshold brightness and threshold lumens.

Extraneous light such as that obtained from starlight may raise the threshold values to ten times that obtained in the laboratory. However, it is possible that authorities having jurisdiction in blackout lighting will consider values appreciably higher than laboratory thresholds sufficiently safe from detection by enemy planes.

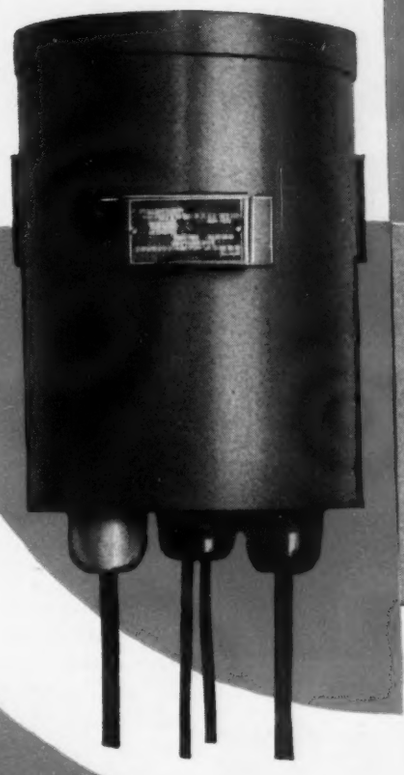
Perception of various colored lights will vary continuously and considerably through the spectrum. "Red" threshold values are higher and "blue" threshold values are lower than "white," but not by any constant amount.

When using the chart it will be noted that for a particular distance the threshold values for foot-lamberts (and foot-candles) will vary over great ranges, depending on the size of the spot, while the threshold lumens for different spot sizes will vary little, particularly for small size spots.

Threshold candle-power of sources or of apparent sources—surfaces such as water, painted or varnished wood, etc., specularly reflect approximately 3 percent of incident light, hence in some cases the candlepower of the source should also be considered from the standpoint of its reflection. Sources smaller than one minute of visual angle may be treated as point sources.

# ANNOUNCING A NEW OUTDOOR POTENTIAL TRANSFORMER.

*The* **JE-3**



**TYPE JE-3**

**For outdoor metering applications 2300 volts and below**

**INSULATION**

**230, 460, and 575 volts—full-wave, 30 kv; 2300 volts—full-wave, 60 kv**

**ACCURACY**

**¼W, ¼X, ½Y**

## NOW, G. E. OFFERS... A complete line of outdoor current and potential transformers, 15 kv and below, which conform to ASA insulation standards

These new standards, which are met by this now complete line of transformers, provide a means whereby all apparatus on a line can be co-ordinated to have the same insulation strength. This facilitates the selection of adequate protective equipment.

All these transformers meet or exceed the highest accuracy standards and can be obtained in a wide variety of mechanical constructions to meet every installation need.

Ask your G-E office for a copy of our new bulletin, GEA-3650, which covers both outdoor current and potential transformers, 15 kv and below. Or write General Electric, Schenectady, N. Y.

**GENERAL ELECTRIC**

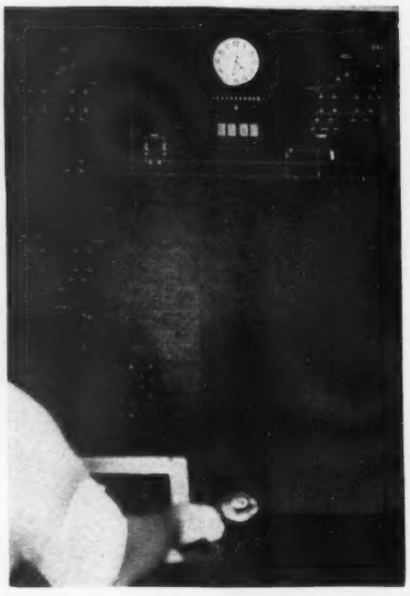
## Switching Stations

# Pilot Board Mimics Switching Operations

An unusually versatile, but complex, semi-automatic pilot dispatching board, under telephone dial control, is used by load dispatchers of the Memphis (Tenn.) Light, Gas and Water Division both to record system switch positions and to perform switching operations in miniature, prior to their actual execution in the field.

Basic element of the pilot board is an ingenious miniature indicating device, used at each circuit switch position, consisting of a small cylindrical target that is rotated by a telephone type solenoid relay. The target surface is divided into four quadrants, colored red, white, green and blue respectively. The target has eight positions, depending on the number of impulses impressed upon its operating solenoid relay. These eight positions (four showing a single color and four showing two colors) are used by the operators to indicate various switch conditions. When the target comes to the red position (indicating a closed switch or breaker) auxiliary contacts on the relay close. These contacts are used on the pilot board to operate pilot lights to indicate lines and buses that are energized when the particular switch is closed.

As on most dispatching boards, each system switch and breaker has an assigned number. To operate this particular switch on the pilot board the operator dials the number on a special telephone dial installed at his desk. This sets the number up in the relay system and shows it in lights on an indicating panel under the clock in the accompanying illustration. The dispatcher next operates a toggle switch and dials a digit between 1 and 8 (inclusive), depending on the switch condition he wishes to set up on the board. As the telephone dial recovers, the target of the particular switch ratchets to the desired position and, depending on whether the switch has been closed or opened, lights or extinguishes a pilot lamp on associated lines and buses.



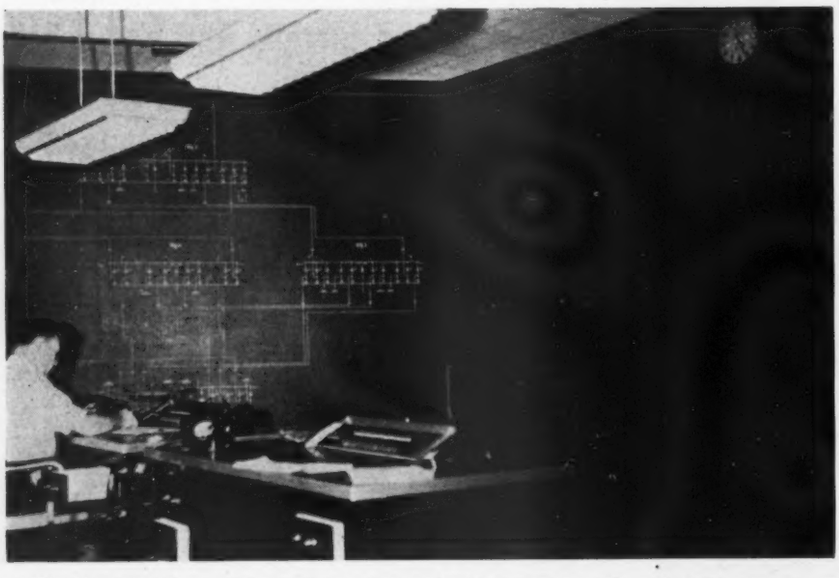
The color code system used by the Memphis dispatchers to identify switching conditions corresponding to the eight positions of the targets are as follows:

1. Red—closed switch.
2. Red-White—o.c.b. and *line* switch open with hold card.
3. White—o.c.b., line switch, bus switch open—hold card on some switch.
4. White-Green—o.c.b. and *bus* switch open with hold card.
5. Green—open switch.
6. Green-Blue—o.c.b. and *bus* switch open.
7. Blue—o.c.b. line switch and bus switch open.
8. Blue-Red—o.c.b. and *line* switch open.

Of all switches not considered as group switches only three of the eight color combinations are used.

1. Red—closed switch.
3. White—open and hold open.
5. Green—open switch.

The board also provides the dispatcher with positive indication of breaker operation in the field. When a breaker at any substation is operated indication on the pilot board is as follows: (1) A horn signal sounds, (2) a number corresponding to the substation number lights on the strip under the clock and (3) lights appear on the pilot board at the substation and breaker position concerned.



**GENERAL VIEW of semi-automatic pilot board used by Memphis dispatchers to record and try out switching operations. Note number (2110) in lights under clock designating switch just operated. Above, operator's hand reaches out to telephone dial controlling pilot board. Under clock note row of digits telling operator number of substation at which actual breaker has operated.**

## Pole Lines

# Self-Supporting Cable Cuts Costs

Installed primarily to do away with the necessity for potheads and messengers, self-supporting aerial cable has effected a 25 percent saving in installation cost for the Staten Island Edison Company. The present installation consists of 500 ft. of Okonite 4,000-volt, three-wire cable made up of three No. 2 conductors, with an over-all outside diameter of 1⅝ in. and weighing about 2 lb. per foot.

In the territory in which the installation was made the poles are

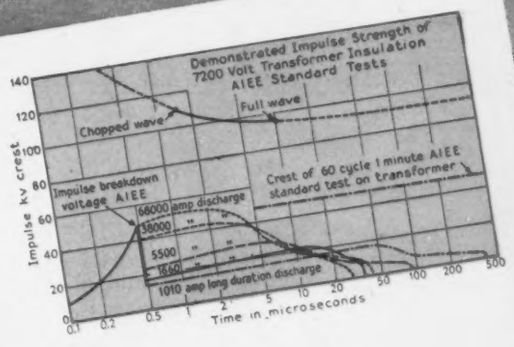
# NOW Reliable Lightning Protection is More Important Than Ever

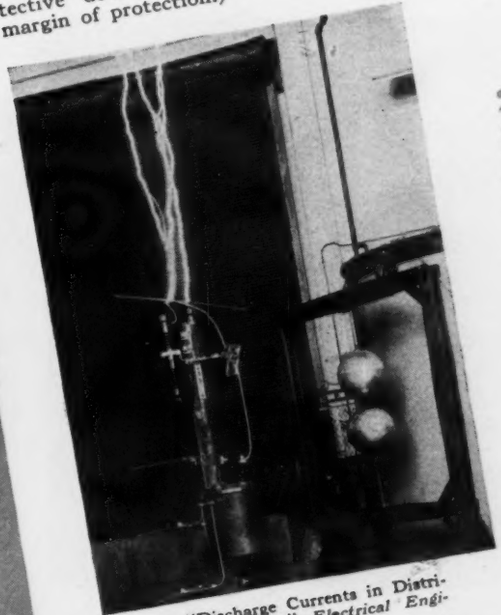
1. It preserves investments in costly or unreplaceable electric equipment.
2. It protects new or old apparatus from damage and keeps it in service.
3. It reduces repair or replacement demands involving vital materials.
4. It prevents interruptions of indispensable power service to consumers.

## ON DISTRIBUTION LINES
### You can be sure of adequate protection with G-E pellet arresters

BECAUSE

**1.** Pellet arresters limit stresses to less than half the impulse strength of the distribution transformer, even with severe lightning discharges. (In this graph, the impulse volt-time oscillograms of the 9-kv pellet arrester are compared with the volt-time impulse test strength of a 7200-volt distribution transformer. No other distribution protective device assures such a large margin of protection.)



*See "Discharge Currents in Distribution Arresters," *Electrical Engineering*, June, 1938.

**2.** Pellet arresters have large discharge capacity. Pellet arresters withstand severe lightning strokes. They have discharge capacity in excess of the highest lightning discharge currents measured on distribution circuits.*

**3.** Pellet arresters have valve action. The best arresters ever made—those used for protection of the most costly power apparatus—have always been of the valve type. In distribution arresters, too, valve action makes for superior continuity of power service and more lasting protection.

***NO NEED TO GAMBLE***

***Select your G-E pellet arrester from Bulletin GEA-2975. General Electric, Schenectady, N. Y.***

General Electric and its employe are proud of the Navy award of E cellence made to its Erie Works f the manufacture of naval ordnanc

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about 100 ft. apart. The cable is supported at the poles by customary three-bolt cable clamps. At the ends of the cable run, about 4 to 6 ft. from the dead-end pole, the individual conductors are fanned out to the insulators. The crotch is properly protected with insulating varnish and rubber tape.

## New Development

### Electronic Control of Sign Blackout

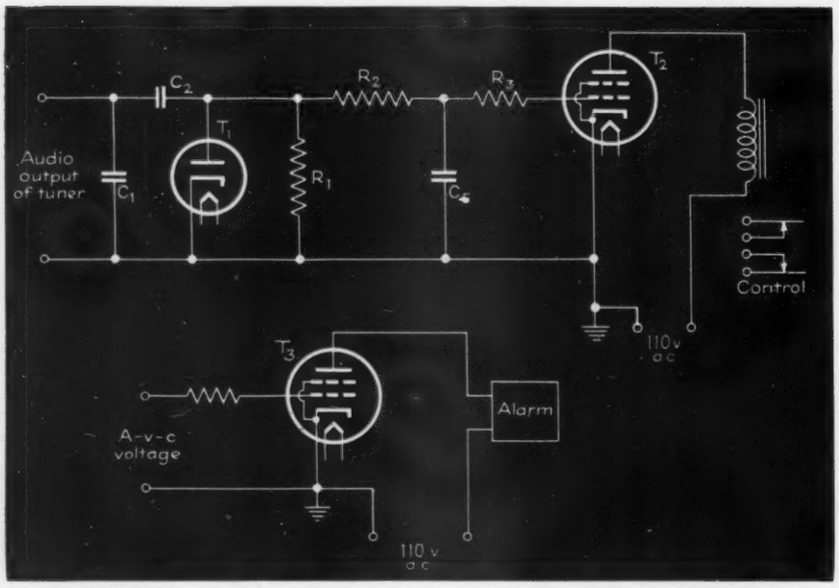
Application to remote control of sign or other lighting circuits during blackouts and air raids is seen for a simple electronic device originally developed to relieve broadcast operators from monitoring another station's programs to intercept air raid warnings.

Any type of radio receiver with automatic volume control may be used to operate the device, which consists essentially of two electronic controls, used in the monitoring device to complement each other. One of these operates from the automatic volume control voltage developed in the receiver and actuates an alarm or other device—for example, a lighting relay—when there is a break in the carrier signal from the station to which the radio receiver is tuned. The second operates from the audio voltage developed when a single tone of predetermined frequency is transmitted—for example, the standard 1,000-cycle tone designated by the Army Interceptor Commands as an air-raid warning—which then is employed to actuate the desired relay or relays.

For the first control the automatic volume control voltage of the receiver is fed to the grid of the "receiver failure" control tube. This voltage is used to bias the tube to plate current cutoff. Any break in this voltage will cause the tube to pass current and to close a relay to control any external circuit or operate an alarm. Recommended control tube for this purpose is a grid-controlled gas tetrode similar to the type 2050.

For the other control a single tone of predetermined frequency is transmitted at 100 percent modulation for a definite period of time—for example, the 1,000-cycle warning tone is transmitted for a 30-second period. This tone is received and rectified and the resultant direct voltage fed to an R-C delay circuit. The grid of the second control tube—again preferably a type 2050 or similar tube—is energized by the voltage developed across this R-C circuit. When the charging voltage across the condenser reaches the proper voltage to cause plate current cutoff, the control delay drops out. The time-delay constant must be large enough so that ordinary program material will not trip the control tube; it is adjusted for approximately fifteen seconds in the automatic monitoring application, so that the device controlled by the circuit will operate at the end of this period.

Manufacturing rights to the automatic monitoring device have been granted to the Washington (D. C.) Institute of Technology. Further details of this application of the fundamental electronic control circuit are presented in the March, 1942, issue of *Electronics*.




**ELECTRONIC CONTROL circuit can be adapted to operate alarm system or lighting circuit switch. Top: Operation on standard 1,000-cycle military warning tone. Bottom: Scheme to actuate alarm—or lamp relay—when carrier of broadcast station goes off the air. Either is a supplement to conventional broadcast receiver**

## Industrial Heat

### Silver Alloy Brazed on Copper Castings

For attaching silver alloy contact materials to base metal parts of switch structures electric brazing is proving of value. An interesting application by the Gibson Electric Company, Pittsburgh, involves heavy copper castings for 4,000-amp. disconnect switches and silver-nickel contact material (Gibsiloy Grade A).

Eight strips $\frac{1}{64}$x$\frac{1}{2}$x3$\frac{1}{2}$ in. were brazed to the jaw and four rings $\frac{1}{64}$ in. thick, 3 in. O.D., 2$\frac{1}{8}$ in. I.D. were brazed to the hinge. Each casting weighed 35 lb. All of the contacts on each casting had to be brazed at one time, otherwise the bonds of the contacts first brazed might be damaged by the heat required to braze the other contacts.

To accomplish this the contacts were placed on the casting and the casting held between graphite electrodes of a 50-kva. welding machine, the outer contacts being held by these electrodes. Inner contacts were also held between graphite blocks which were pressed against the contact material by a wedging clamp. Very little current passed through this inner clamping device because it was bypassed by the base of the copper casting itself. Most of the heat was therefore generated in the outer electrodes. The casting had to be brought up to heat slowly in order to give time for as nearly an even distribution of heat as possible, so that the inner contacts could be brazed before the outer contacts tended to melt.

Brazing medium was silver solder which had been applied as a solder flushing on the sheets of silver-nickel

WITH THIS NEW BREAKER WE CAN GET POWER BACK ON THE LINE IN LESS THAN A MINUTE.
SURE, AND YOU CAN TAKE THE BREAKER OUT AND INSPECT IT IN A COUPLE OF MINUTES.
AND IF THE LOAD GETS OVER A HUNDRED AMPS ON THIS CIRCUIT WE CAN JUST SLIP IN ANOTHER BREAKER UNIT.
GENERAL ELECTRIC
AIR CIRCUIT BREAKER

# Here's Why YOU'LL Like This New G-E Removable Breaker

THIS air circuit breaker is built to meet today's demands for quick installation, and dependable protection for continuous production. Its features include a simple ingenious new method of mounting and a convenient, modernized enclosing case, which combine to give you a removable breaker that is easy to install, easy to operate, and easy to inspect.

We call it the *3-minute breaker*. You can re-establish service after temporary faults in less than *one* minute . . . inspect the breaker unit in safety—away from live parts—in less than *two* minutes . . . and where changed load conditions call for a different-rated breaker of the same type, the old unit can be removed and a new one installed in less than *three* minutes.

Give your production, equipment, and personnel complete protection. Install these breakers in lighting, power, and motor circuits —up to 600 volts. They will protect both the circuit wiring and the apparatus connected to the circuit. A new pictorial booklet (GEA-3600) tells where and how to use them. For a free copy, call the G-E office near you, or address General Electric, Schenectady, New York.

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860-20-7500

***THE BREAKER WITH THE DISCONNECT FEATURE***

from which the contacts were made.

The copper blades of the switches were also equipped with silver-nickel contacts. To each blade were brazed two strips of contact material $\frac{1}{64}$x$\frac{1}{2}$x $3\frac{1}{2}$ in. and one ring $\frac{1}{64}$ in. thick, 3 in. O.D., $2\frac{1}{8}$ in. I.D. In this case one end at a time could be heated, so that the two strips were brazed to one end of the blade at one time and the ring brazed to the other end as a separate operation.

Although the foregoing case involves the application of contact material to large switch parts, electric brazing is equally applicable for attaching contacts to smaller parts such as contact fingers, screws, studs, springs, stampings and extruded sections.

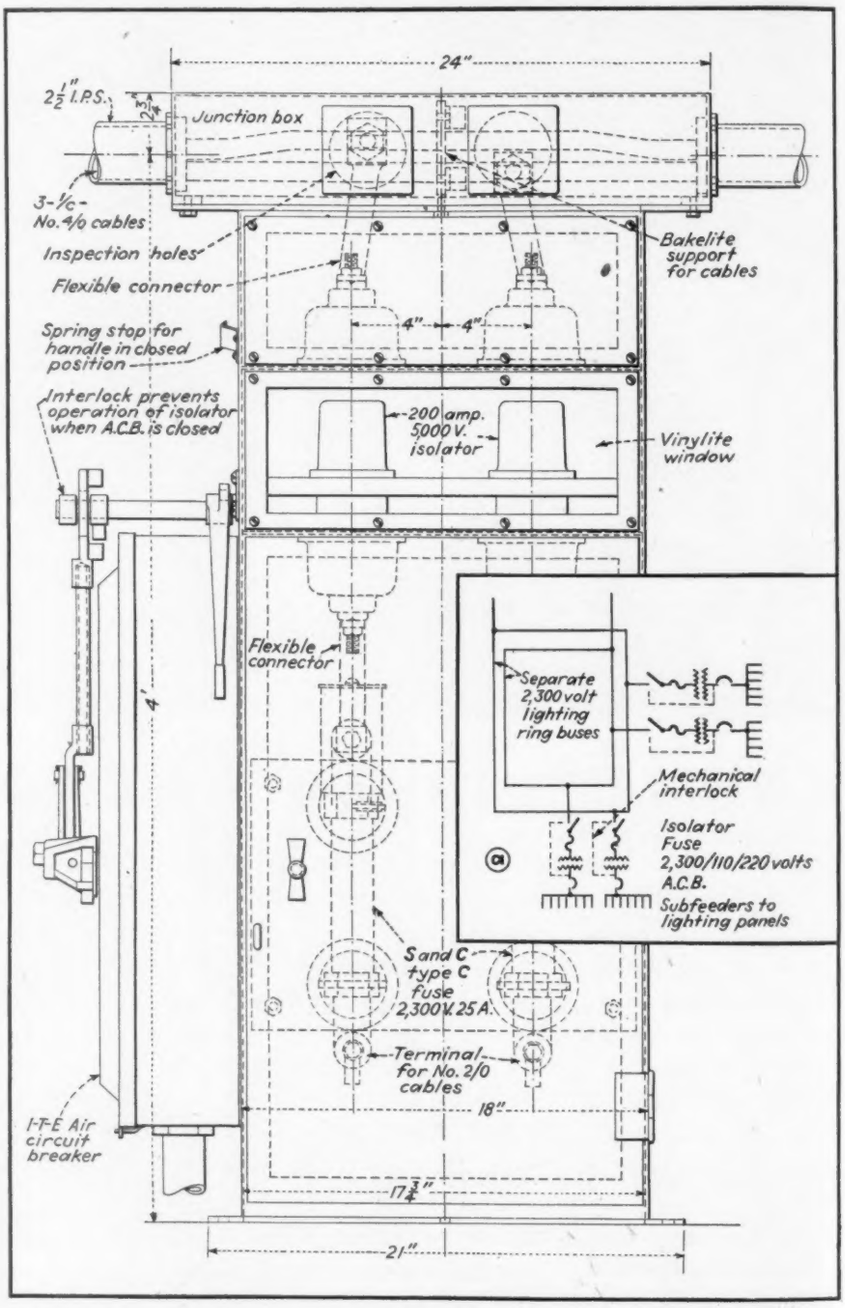
## Protection

## Unit Protection for Indoor Transformers

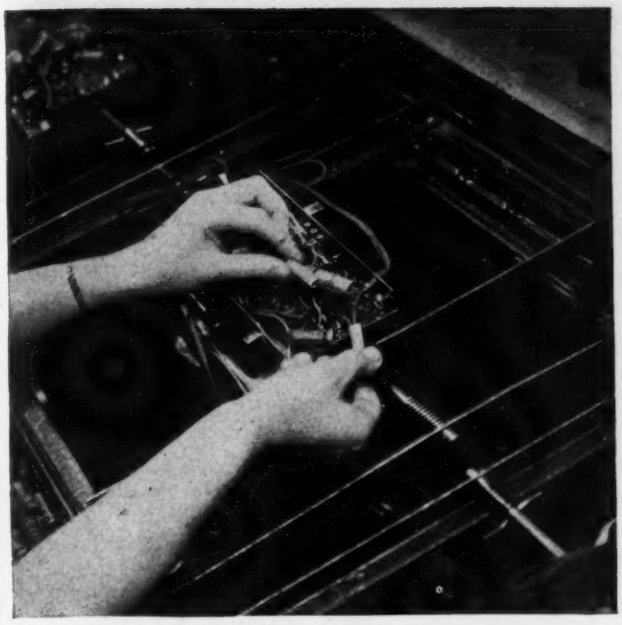
For the primary protection of indoor lighting transformers one of the newer eastern aircraft plants has introduced a novel, metal-clad protection unit that fits compactly between transformer and conduit-inclosed 2,300-volt lighting bus. The unit houses an "Isolator" type disconnect switch and condenser-type fuses. Main secondary air circuit breaker is attached to the protection unit and interlocked with the disconnector mechanically so that it cannot be opened while the secondary breaker is closed.

System on which the unit is used consists of two separate, closed 2,300-volt lighting rings. Alternate lighting transformers, of which there are fifteen in all, are connected to the same lighting ring by means of the protector unit. This arrangement was used in preference to the more conventional radial system with a limited number of lighting transformers of large size, serving large individual service areas. By resorting to the 2,300-volt lighting rings and a large number of small 50-kva., single-phase 2,300-115/230-volt transformers it was possible to keep down the length and number of feeders and conserve on the cost of switchgear. The multiplicity of small transformers made it possible to serve the lighting load with a few short, low-voltage sub-feeders from each transformer location. Smaller, less expensive switchgear was also permitted by this arrangement.

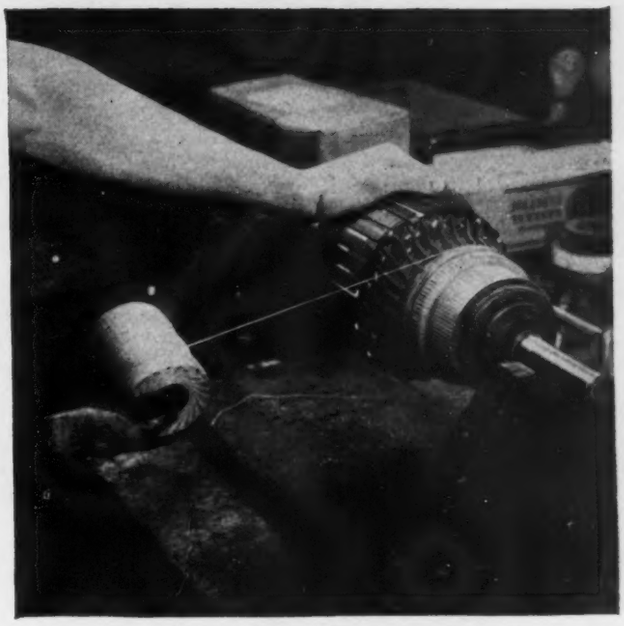
The protection unit manufactured to special specifications by the Electrical Engineers Equipment Company used with this system has these notable features: (1) It provides a completely "armored" installation from the high-tension lighting bus to the transformer. (2) By resorting to an "Isolator" instead of a knife switch the primary fuse and disconnecting means is housed in a short (4-ft.) inclosure bringing bus and transformer close together. (3) Conductors of the 2,300-volt lighting loop, at each transformer location, pass unbroken through a three-sided junction box which is the top compartment of the unit. Flexible tap connections from the loop pass throughout the bottom of this compartment to the disconnector fuse and transformer terminals. (4) The mechanical interlock between the primary device and the secondary breaker makes the operation of the protection unit substantially foolproof. (5) Unit shown is single phase; three-phase units are available.




**ASSEMBLY DETAILS** of armored primary protection used for lighting transformers on 2,300-volt ring bus in eastern defense plant. Inset (a) shows scheme of electrical system



*G-E Varnished Tubing used on power leads in radio chassis for extra protection.*



*G-E Twine being applied to front end of commutator for extra protection.*

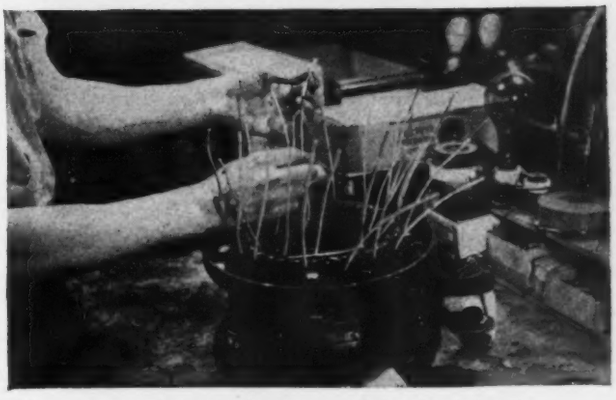
# PREPARE

## WITH *Extra Protection* ... USE G-E

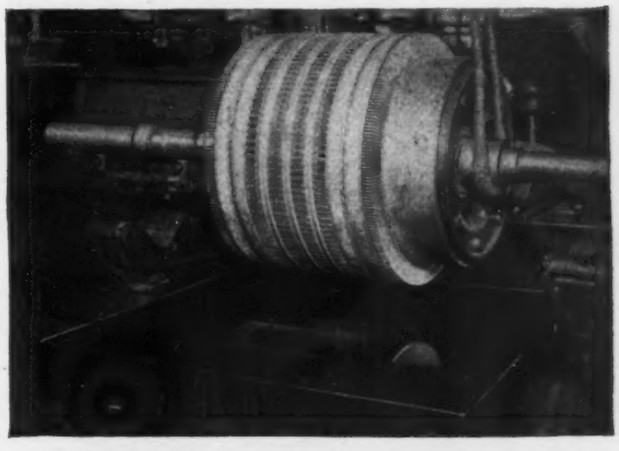
## INSULATING MATERIALS

Victory demands preparedness. Insist that your equipment is prepared with the *extra protection* of G-E Insulating Materials.

The complete line of high-quality General Electric Insulating Materials is fully described in the G-E Insulating Materials Catalog. If you do not have a copy, please see your nearest G-E Merchandise Distributor, or write to Section M-293, General Electric Co., Appliance & Merchandise Dept., Bridgeport, Conn.



*G-E Varnished Tubing applied to coil leads affords extra protection.*



*Large armature about to be dipped into G-E Insulating Varnish for extra protection.*

GENERAL ELECTRIC

## Industrial Heat

# Electric Energy for Drying Grass

Sufficient fodder rich in albumen, the greater part of which had to be imported in normal times, is difficult to obtain in Switzerland under present war-time conditions. To remedy the lack, artificial grass drying is being developed so that concentrated fodder can be produced from home-grown fresh grass.

In the drying process, according to the Brown Boveri *Review*, electric power is used for heating the grass and for operating a fan motor to recuperate the heat contained in the steam and air mixture for transmittal to another part of the machine for drying of the material. A remarkably high quality of dried grass is said to have been produced to feed the cattle.

The electric grass-drying apparatus with heat recuperation consists of (1) a charging belt (which can be replaced by a grab hoist), (2) two drying chests with belt conveyor, (3) a set of fans, motor-driven, with electric air heater, and heat exchanger, and (4) a discharge belt.

Capacity of the dryer is 1,000 kg. of steam per hour, corresponding to a production of 250 kg. of dry grass per hour with a water content of 10 percent, the water content of fresh grass being 82 percent. Energy consumed per kg. of vaporized water is 560 calories or 0.7 kw.-hr. of power input, including motor developing 650 kw. Three of these machines, it is said, will provide concentrated fodder for about 2,000 head of cattle.

Some data relating to the process follow: Fresh grass contains up to 20 percent of dry substance containing nourishment; the remainder is water which must nearly all be eliminated. The remaining amount of water in dry stuffs should not much exceed 10 percent on an average, if mold is to be avoided. Thus, from 100 kg. of grass 80 kg. or more of water must be drawn off. Very little can be accomplished by pressing, and this only at the expense of a loss of valuable juices; hence the water is eliminated in the form of steam. Heat of evaporation for a kg. of water is about 600 calories under vacuum and rises theoretically to over 700 calories when atmospheric air is freely admitted.

**Electric Energy Required for Artificial Grass Drying**

| Kind of Grass | Clover Very Wet | Meadow Grass | Cut Previous Day | Coarse Tall Grass | Rich Grass |
|---|---|---|---|---|---|
| Water content, percent | 84 | 84 | 82 | 74 | 85 |
| Length, cm | 50–60 | 20–50 | 10–40 | Up to 40 | Short |
| Amount, kg | 2,309 | 1,500 | 1,103 | 1,075 | 1,082 |
| Processing time, hours, minutes | 8:40 | 6:55 | 4:43 | 4:13 | 5:13 |
| Dry grass, kg | 417 | 269 | 217.5 | 307.6 | 164 |
| Water content after drying, percent | 11 | 10.8 | 10 | 8 | 10 |
| Ratio dry grass to fresh grass | 1:5.5 | 1:5.6 | 1:5.1 | 1:3.5 | 1:6.6 |
| Evaporated water, kg./hr | 219 | 178 | 189 | 182 | 176 |
| Energy input for heating and motor | | | | | |
| Kw.-hr., total | 1,478 | 1,015 | 720 | 635 | 783 |
| Kw.-hr. per hour | 170.5 | 147.5 | 152.5 | 151.3 | 150.3 |
| Kcal. per hour | 148,000 | 127,000 | 131,000 | 130,000 | 129,500 |
| Energy expended, kcal/kg. of water | 669 | 713 | 700 | 710 | 733 |

Note: Cm. = 0.3937 in Kg. = 2.2046 lb.

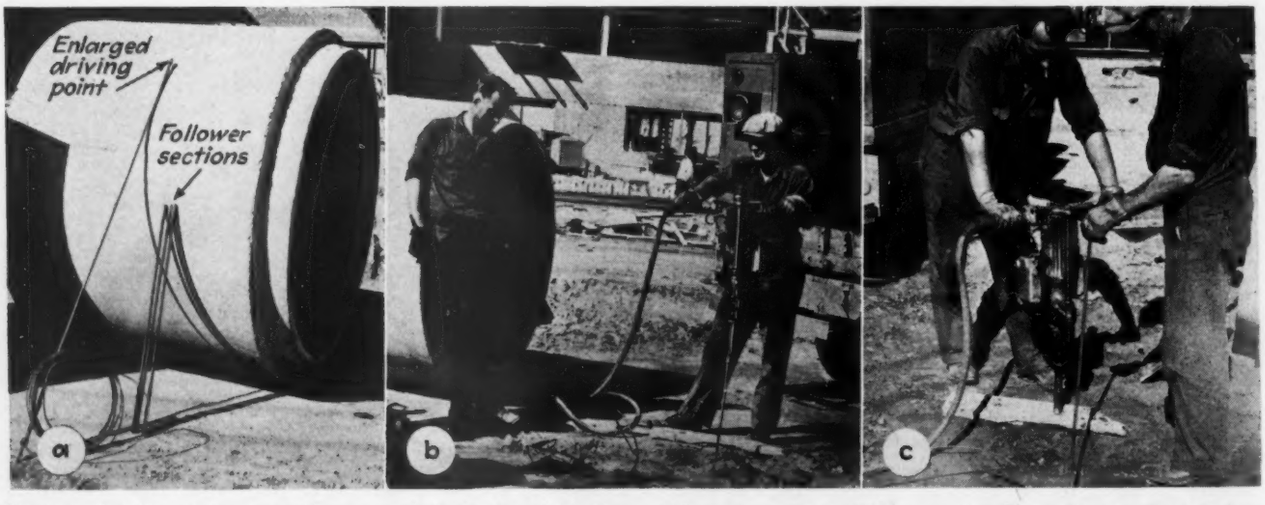
## Service Operations

# The Life of a Service Man

To provide for maintenance of lines in rural territory meter readers have been trained to patrol the lines while on their routine trips. As told by W.

## Substations

# Testing Soil Conditions for Substation Grounding




The Detroit Edison Company utilizes a method developed by the testing division of its electrical system department. Test ground rod (a) of ½-in. diameter copper 6 ft. long, with wire lead brazed on, is driven to necessary depth with Barco gasoline hammer (b) by adding as many iron follower sections ½-in. diameter by 3 ft. long as required (c). Enlarged point on ground rod facilitates driving. Using "Megger" ground resistance tester, crew measures both short-circuit current and resistance to determine the necessary grounding.

# G-E

## Wiring Materials Distributors CAN HELP YOU ACHIEVE PLANT EFFICIENCY FOR WAR REQUIREMENTS

H. McDaniel, (left) electrical engineer for the Kalamazoo Vegetable Parchment Company, Kalamazoo, Mich., depends on Fred Telder, General Electric Supply Corporation salesman of the same city because Fred gives him the prompt service he needs to help keep the large machines in his plant operating day and night. This association began 9 years ago.

G-E Distributor salesmen give service. Here J. K. Ewing (left) salesman at the General Electric Supply Corporation house, Hammond, Ind., is in the stockroom checking up an order from E. S. Disbrow (right), owner of the Tri City Electric Service Co., Hammond, Ind. Mr. Disbrow is selecting materials for givernment work he is handling.

Like other distributors, G. W. Knowlton (left), sales manager at the Des Roberts Electrical Supply Co., Lynn, Mass., wants to provide his customers with materials especially for war projects and at the same time be able to replace his stocks. Therefore, he gives his customers all information possible on priority procedure as he is doing above for B. A. Marshall, local contractor.

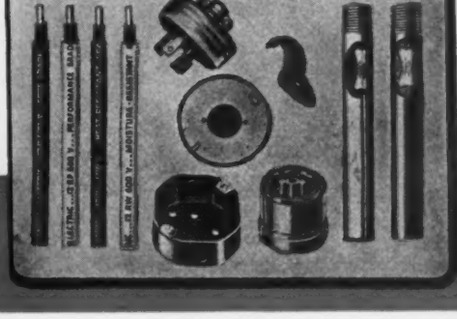
Arthur P. Bagley, Jr., (left) Bagley Elevator and Electric Co., Birmingham, Ala., is showing the new switchboard the Bagley company installed in Birmingham's First National Bank building to E. L. Burland, General Electric district representative, and is complimenting the service given by the Matthews Electric Supply Co., Birmingham. The new switchboard was part of an electrical modernization program completed last year.

Demands, piled one on top of another . . . frantic cries for faster production . . . record-breaking manufacturing schedules. No need to remind you that today's War Program calls for hard work, long hours and *eager-to-help sources of supply.*

Your G-E Wiring Materials Distributor is geared to handle your urgent needs. With experienced man power, problem-answering products and timely ideas, this organization of "friendly neighbors" stands ready to cooperate with you in assisting war efforts.

Ask the representative of the G-E Wiring Materials Distributor in your locality about conduit to provide sturdy protection . . . cables to withstand a particular condition . . . wiring devices that lend themselves to rapid installation. Call upon him to help you solve war time wiring problems. *That's his job, and he does it well.*

There's a complete line of Wires and Cables, Wiring Devices and Conduit Products to solve every plant wiring problem. Call your G-E Wiring Materials Distributor. Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.



GENERAL ELECTRIC

L. Rush, Louisiana Power & Light Company, at a recent meeting, the meter readers of his company are furnished with service trucks and can take care of considerable routine maintenance. If they see anything that needs to be done they attend to it at the time, if possible, or if not then a memorandum is made and the job is attended to by a maintenance crew.

A report from one of the meter readers, who is considered to have the toughest operating job in the state, included a paragraph listing things a service man is expected to do. According to a classification, the duties are:

1. *Meter and Service* — Reading meters; collecting; attending to merchandise service; other services on customers' premises, installation orders, cut-ins and cut-outs; taking applications for service; obtaining information for the office on customer complaints; securing information on prospective customers for the district manager to follow up.

2. *Patrol*—Patrolling the lines and maintaining them properly or making an accurate report so that they may be properly handled; watching the load on transformers; making voltage checks for overloaded conditions; keeping the truck properly loaded to have minimum amount of material such as meters and fuses and still have the necessary equipment to take care of emergencies as they arise.

3. *Inspection*—In territory where there is no wiring inspection necessary, make an inspection of the entrance for grounds, etc., before service is connected and check meter with lights turned on before leaving; watch his collections; know customers, credit rating; keep a check on street lights for burn-outs, broken or defective bulbs, keeping clocks and fixtures in good condition to minimize night calls for street light replacements.

4. *Miscellaneous*—Keep an accurate record of everything done, of all material used or taken down; see that time sheets and truck mileage are properly charged; see that truck is kept clean and in as good condition as if it was his personally owned car; "stay on night duty at home and subject to call two or three nights a week plus some holidays and Sundays," and attend meetings that are held by the company.

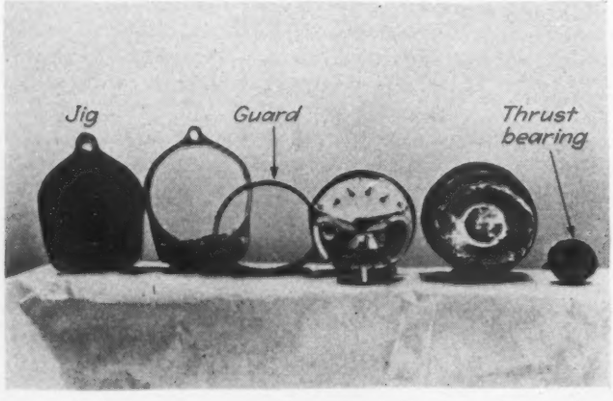
## Meters

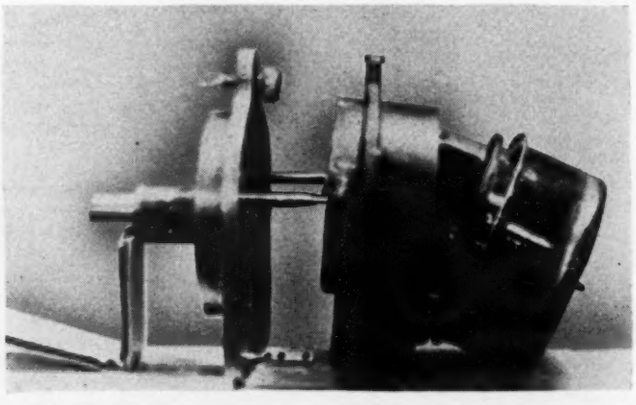
# Socket Conversions Done on 9-In. Lathe

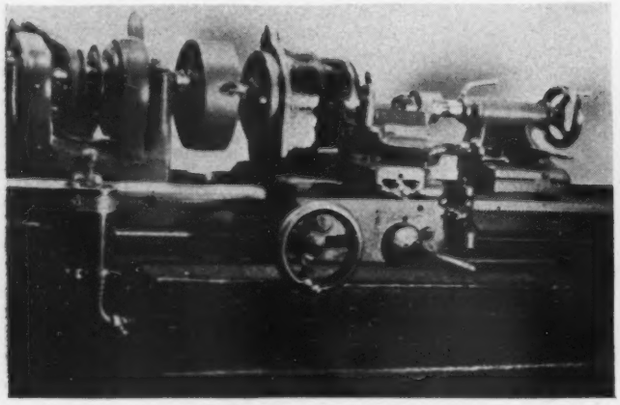
By C. IATONNA
Superintendent Electric Meters
Pennsylvania Power Company, New Castle

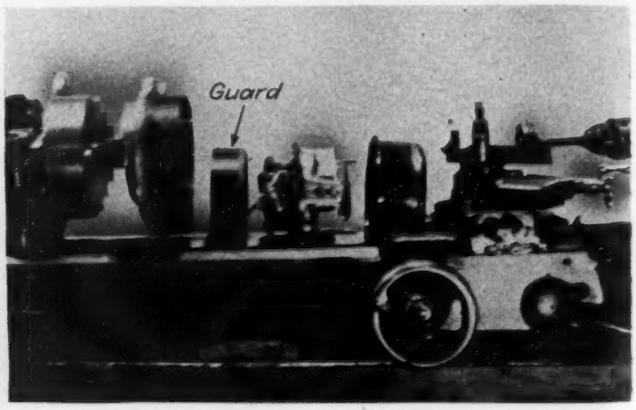
When starting to rebuild I-14 and I-16 meters to socket type we disassembled them, cut the base off and reassembled. The job is now done on a lathe and it is not necessary to remove any parts except to disconnect the leads from the terminals. The thrust-bearing (inserted in a drill chuck which fits into the tail stock) has a head which rotates freely when pressed firmly against the meter cover and holds the meter together after the cutting operation and until the detached parts are ready to be removed.

**JIG and thrust-bearing aid rebuilding of G.E. I-14 and I-16 meters to socket type (left). Jig has removable posts which can be screwed into positions to accommodate either I-14 or I-16 meters and was made of ⅝-inch boiler plate (right)**








**JIGGED meter on South Bend 9-in. workshop lathe ready to cut off the meter base. An 11-in. lathe would give more generous working clearance (left). Guard, a ring cut from standard metal meter-cover, keeps dust and cuttings from getting into meter element during the operation. Felt gasket provided at rim next to meter element**

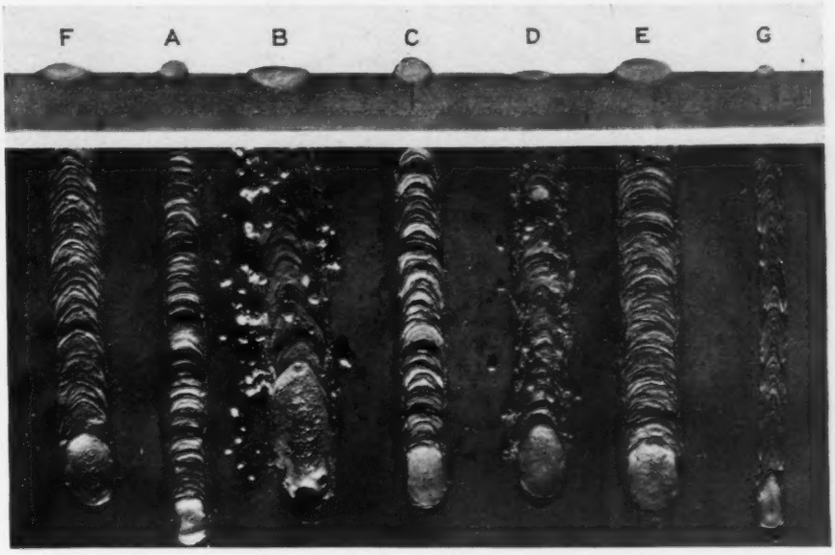
# WAYS TO CONSERVE WELDING ELECTRODES

Industrial Heat

**CLAYTON B. HERRICK**
Welding Engineer
Lincoln Electric Company, Cleveland, Ohio

Conservation in welding deserves increasing attention, and this is particularly true of welding electrodes. Conservation suggestions include these: Select the proper size electrode and use the correct current and voltage settings. From the standpoint of electrode selection, the largest diameter electrode which can be used effectively is the best. Since every electrode manufactured is designed to operate at a certain voltage and within a specified current range these values should be carefully observed.

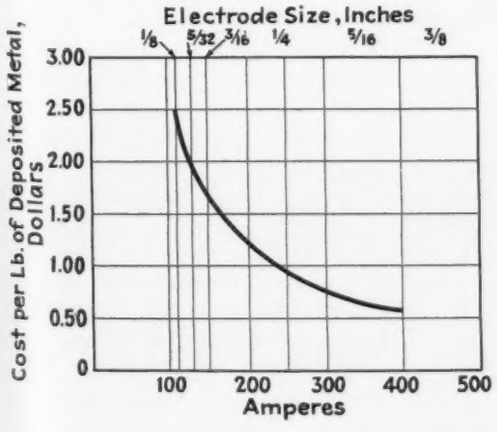
Advantages of following these suggestions, both in effecting economy of cost and proper weld characteristics, are pointed out in the accompanying chart and tables.




| | "F" | "A" | "B" | "C" | "D" | "E" | "G" |
|---|---|---|---|---|---|---|---|
| ARC CURRENT | Normal | Low | High | Normal | Normal | Normal | Normal |
| ARC VOLTS | Normal | Normal | Normal | Low | High | Normal | Normal |
| ARC SPEED | Normal | Normal | Normal | Normal | Normal | Low | High |
| BURN OFF OF ELECTRODE | Normal appearance; coating burns evenly | Practically same as preceding | Coating is consumed at irregular high rate—watch carefully | Coating too close to crater, touches molten metal resulting in porosity | Drops at end of electrode flutter and then drop into crater | Normal | Normal |
| PENETRATION FUSION (CRATER) | Fairly deep and well-defined | Not very deep nor well-defined | Deep, long crater | Small | Wide and rather deep | Crater normal | Small, rather well-defined crater |
| APPEARANCE OF BEAD | Excellent fusion— no overlap | On top of plate. Not as much overlap as with bare rod. | Broad, thin bead; good fusion | High bead—not as pronounced as for low amps.; somewhat broader | Wide, spattered | Wide bead—overlap large. Base metal and bead excessively heated | Small bead—undercut. Reduction in bead size and under cutting depends on speeds and amperes |
| ARC SOUND | Sputtering hiss plus sharp crackling | Irregular sputtering, some crackling | Regular explosive sounds | Hiss plus steady sputter | Soft sound plus hiss and few crackles | Normal | Normal |

**WELD CHARACTERISTICS** are a good check on electrode conservation. If current is too high or too low, it will show up in excessive spatter loss inferior welds, having improper fusion and penetration

**WELDING COST** decreases as size of electrode increases; saving runs up to 40 percent per pound deposited, for example, when ¼ in. is used instead of 3/16 in. Note also from the table effect on electrode consumption rate, pounds of electrode deposited per hour, number of stub ends (indicated by interruptions per pound consumed), and cost of interruptions to change electrodes




## Effect of Changing Electrode Size

| Electrode size | 1/8 | 5/32 | 3/16 | 1/4 | 5/16 | 3/8 |
|---|---|---|---|---|---|---|
| Amperes | 110 | 130 | 150 | 250 | 325 | 425 |
| Arc volts | 24 | 25 | 26 | 30 | 34 | 38 |
| Kw. at arc | 2.64 | 3.25 | 3.9 | 7.5 | 11.1 | 16.1 |
| Consumption rate, lb. per hour | 2.6 | 3.3 | 3.95 | 7.5 | 10.7 | 16.2 |
| Deposit, lb. per hour (50% operating factor) | 0.87 | 1.1 | 1.32 | 2.5 | 3.57 | 5.4 |
| Efficiency of set (%) | 47 | 50 | 51 | 55 | 59 | 59 |
| Kilowatt input | 5.6 | 6.5 | 7.65 | 13.65 | 18.8 | 27.3 |
| Interruptions per lb. consumed | 18 | 12 | 8 | 5 | 3 | 2 |

### Cost per Pound Deposited

| | | | | | | |
|---|---|---|---|---|---|---|
| Labor | $1.150 | $0.909 | $0.758 | $0.400 | $0.280 | $0.185 |
| Overhead | 1.150 | 0.909 | 0.758 | 0.400 | 0.280 | 0.185 |
| Power | 0.064 | 0.059 | 0.058 | 0.055 | 0.053 | 0.051 |
| Electrode | 0.150 | 0.135 | 0.127 | 0.127 | 0.127 | 0.127 |
| Cost of interruption (including overhead) | 0.050 | 0.033 | 0.022 | 0.014 | 0.008 | 0.005 |
| | $2.564 | $2.045 | $1.723 | $0.996 | $0.748 | $0.553 |

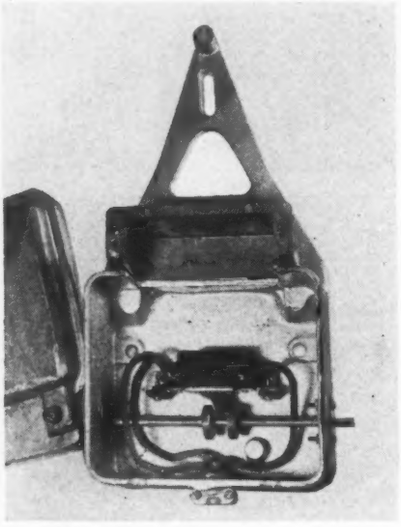
## Lighting

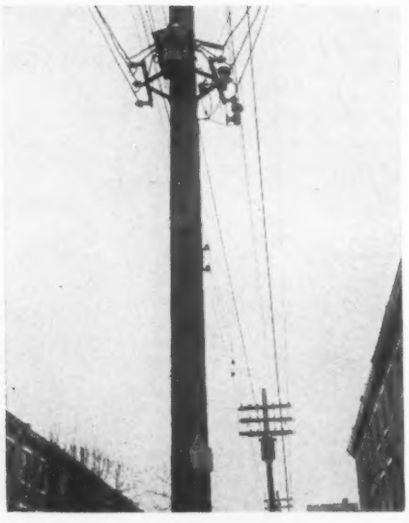
### Low-Cost Switch Used for Blackout

By connecting single-pole, double-throw switches in the series street-lighting circuits a means was provided for blackout of the street lights in Philadelphia and for manual control of the light by air raid wardens. Installation cost for 260 switches was less than $25 each.

Each switch parallels the clock contacts of a time switch which operates a circuit breaker on the primary side of a constant-current transformer.

The blackout switch consists of a meter box containing an ordinary three-way tumbler switch operated by a pair of disks set on a push rod which is movable back and forth, one rod end always projecting from a side of the inclosure. The switch boxes were mounted on the transformer poles, sufficiently high to be out of hand reach. Each switch is operated by striking the projecting rod by a stick similar to a drum major's baton furnished to an air raid warden with a street light control assignment.





**BLACKOUT SWITCH, housed in a meter inclosure, consists of a double-throw, single-pole tumbler switch operated by disks on sliding rod which is struck on either end by stick in hand of air raid warden (left). Switch is mounted on transformer pole out of hand reach (right)**

## Underground Lines

### Selecting Rope for Cable Pulling

By F. L. SPANGLER
Consulting Engineer, Elmhurst, Ill.

In pulling underground power cables between manholes, the following factors should be considered when selecting the rope:

1. The customary small diameter of the sheaves and of the drum or capstan causes rapid fatigue of the rope and clean-cut breaks in the exposed wires, reduces the reserve strength of the rope and results in frequent replacement. Whenever possible, the drum or capstan should be positioned so that the rope is not subjected to reverse bends, which are particularly destructive.

2. Where the lead between the fair-lead sheave and the drum is too short to insure good spooling, a capstan or "niggerhead" may be required, and the rope must be played off the capstan by hand and guided to a reel on which it is wound. This operation may cause barbs if broken wires in the rope have a tendency to stick out.

3. Where the conduit is laid with sharp turns, which must be negotiated by the rope, abrasion of both the conduit and rope may result at these points, particularly if the rope is not very flexible.

For this type of work it is usual practice to use a 6x19 rope (six strands of 19 wires each) with diameters up to ½ in. or more, depending on the length of pull and the size of the cable. If the work demands a more flexible rope, 6x37 construction may be used. If there is a tendency for the rope to crush on the drum, the rope should be provided with an independent wire rope center instead of hemp center.

To prolong the life of the rope and to prevent broken wire ends from protruding, many power companies use preformed rope, whose long life is attributed to its high resistance to fatigue.

One electric utility company which employs capstans instead of drums for pulling cable has pulled, it is estimated, 5,000,000 ft. of cable by means of a preformed rope.

The preformed rope known as "Spring-Lay" is composed of six independent ropes laid around a hemp center, each of these small ropes consisting of alternate strands of wire and hemp. It has been used in two sizes, 1¼ in. and ¾ in. diameters.

Winch drums used for cable pulling are usually 8 in. in diameter and have various widths depending on the length of the rope. To obtain good spooling, the rope lead, which is the distance measured from the fair-load sheave to the drum, should be not less than twenty times the width of the drum, with the drum so located that a plane midway between the two flanges coincides with the plane in which the sheave lies.

## Lighting

### On Cleaning of Lighting Reflectors

Dirt on lamps and reflectors is a great thief of light in the average shop. The average loss is probably at least 25 percent. There are places in nearly every shop where increases of from 50 to 100 percent in light output can be obtained by a simple cleaning of the reflectors.

In view of the amount of losses, the reason more work is not done to keep the lighting equipment cleaner is probably the inconvenience and difficulty of cleaning. A thorough job requires that the reflectors be lowered to the floor and there cleaned in a tub of soapy water, rinsed, dried and then replaced.

Recently tests have been run in

(Driver) Those big windows sure give me full driving vision
It's swell to have a restful ride back after a hard day's work
Lots of ventilation in summer goes over big with me
I like those roomy upholstered lazy-back seats
It's great to have a place to thaw out on cold days
That safety door in back partition gives me a comfortable feeling
(Foreman) I'm glad to have my men all together with me
SEVEN HAPPY LINEMEN

# SEVEN-MAN CREW COMPARTMENT IS SAFE, ROOMY AND COMFORTABLE

● You increase the efficiency of your linemen, improve their morale, and assure their safety by providing for their comfort with this seven-man crew compartment. Progressive utilities recognize this, and American has developed the Model 3714 to meet a steadily growing demand. Built integral with the body, this compartment accommodates the crew without unduly encroaching on the space for carrying materials.

## MODEL 3714

The material compartments along the sides, for instance, extend the same full length as in a standard body.

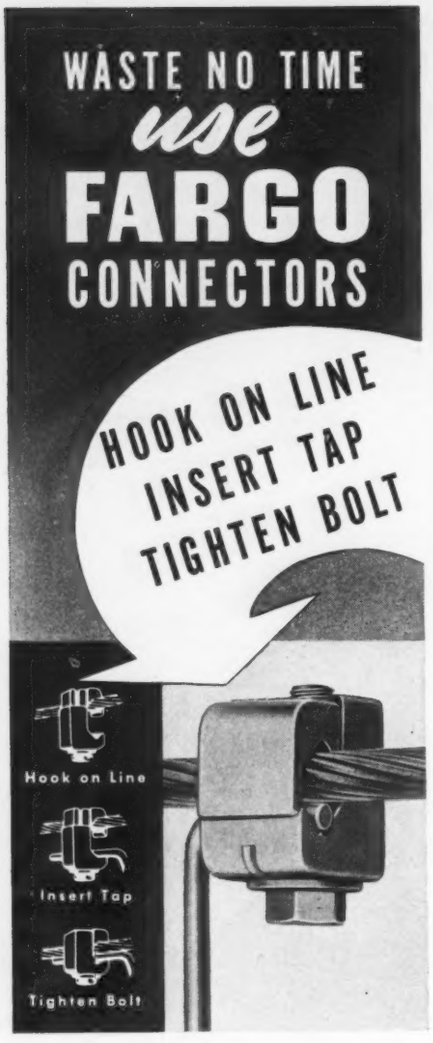
Noteworthy features of the Model 3714 are large drop-windows in sides for ample ventilation in summer; bus-type door; emergency door in back partition; insulated roof; well-upholstered lazyback seats with tubular frames, and many other superior points.

*Send for illustrated bulletin.*

THE *American* COACH & BODY CO.

WOODLAND AVE. AT E. 70TH, CLEVELAND, OHIO

PUBLIC UTILITIES EQUIPMENT FOR MOTOR VEHICLES




Fargo — the connector with the "vise-like" grip is just that easy to use — merely hook on line, insert tap and tighten the bolt.

Perfect machining of body and bolt threads and a small bolt with little friction area result in remarkably high pressure contact between conductors with little wrench force.

V-groove body with wide pressure areas make the Fargo vibration-proof and guard against wire slippage.

Specify Fargo — the "vise-like" — connector.

Made by FARGO MFG. CO.
*distributed by*

LINE MATERIAL CO.
MILWAUKEE, WIS.


many industrial plants which required cleaning several reflectors in each interior. To facilitate this work the reflectors were cleaned in place. This was accomplished simply and thoroughly by wiping the reflector first with a damp cloth which removed the surface dirt. Next, the reflectors and lamps were sprayed with a cleaning compound that contained a wetting agent and solvents. Then the reflectors and lamps were wiped with a dry cloth and the efficiency was restored to initial values. The cleaning compound was similar to "Windex" or "Aeromist," or other commercially available materials used for window cleaning.

The advantage of this method is that reflectors can be thoroughly cleaned without the possibility of water or a cleaning compound being dropped or splashed upon the machinery or work being carried out below.

Kinds of dirt which were encountered on this survey included oil deposit from heat-treating furnaces and heavy cutting oils, greasy aluminum dust from aluminum grinding and the general accumulation from the machine shops and the assembly areas.

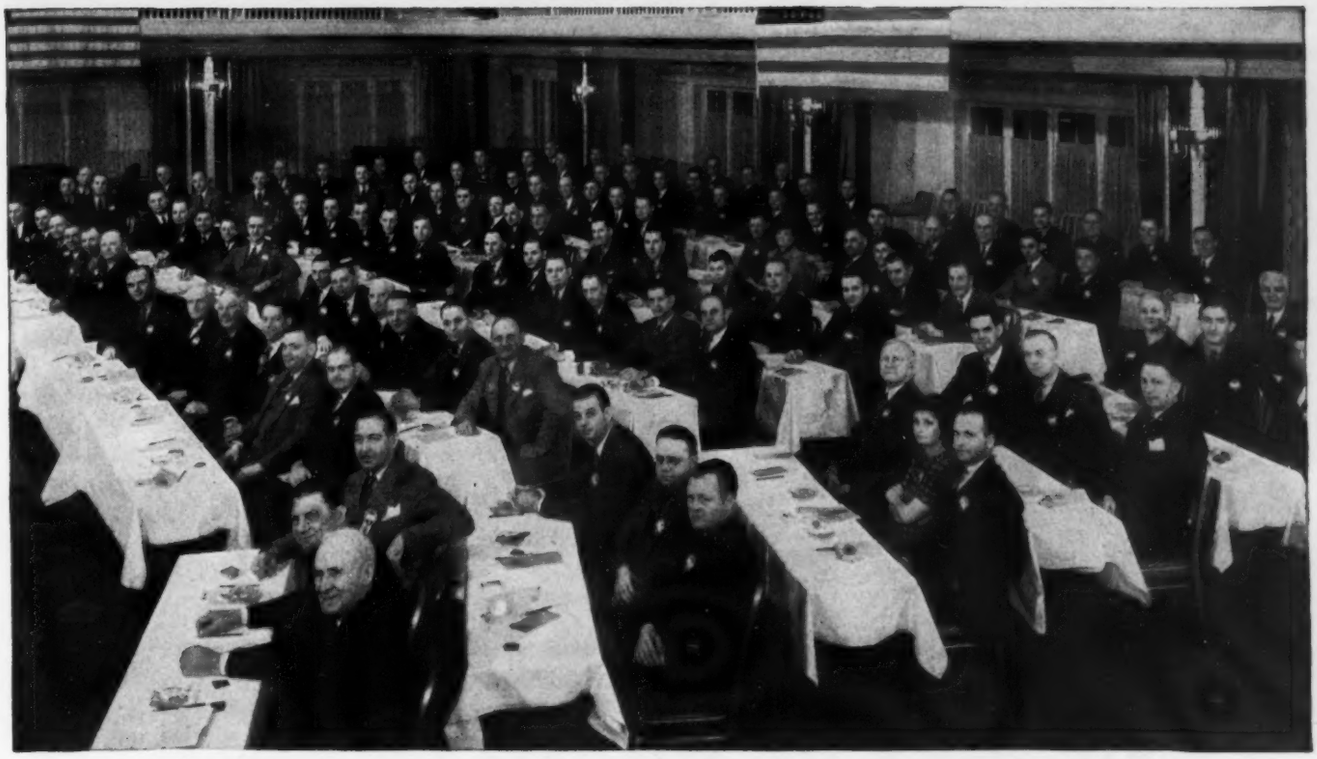
Where the reflector and lamp cleaning can be done on the floor, probably a more thorough job will take place. It is logical that a man on a ladder is much more interested in staying on the ladder than in cleaning the lighting equipment. However, in some cases it is not practical to lower the equipment, and the above suggestions may offer a more satisfactory method than those now in practice.

## Industrial Power

## Motor Auxiliaries Extend Machine Range

Coordination of electrical and mechanical auxiliaries for speed adjustment of individual machine tools at the expanded Indianapolis plant of Marmon-Herrington has greatly extended the field of application of individual machines. Example is the Whitney milling machine shown, which until recently was driven from a line shaft through two jack shafts and a cone pulley to provide four forward speeds. When individual motor drives were installed in the machine shop a 2-hp., 220-volt, two-speed, 1,200/600-r.p.m., three-phase, induction motor was installed on this machine and equipped with a mechanical gear-shifting attachment that provided four forward speeds starting at 12 r.p.m. To this was added an electrical reversing control giving an equal number of speeds forward and reverse. Now this machine can be used with either a right or left hand cutter and its field of application is vastly increased.

**ELECTRICAL CONTROL used with two-speed motor permits motor to operate at same number of speeds in either forward or reverse direction, extends use of machine tool**



*Chicago R. D. L. meeting Feb. 2, 3, and 4. Many helpful suggestions were received equally enthusiastically by both the attending delegates and General Electric.*

# . . . and the Future, too

But it also means keeping good will and maintaining the Dealer's name before the public as the local headquarters for electric appliances . . . the place where people will go to buy the appliances they've been wanting when things get back to normal.

General Electric plans, through *continued* national advertising, to keep alive Mrs. America's interest in electric appliances and what they can do for her. And, of course, the basic structure of G-E's services to its retailers and the public will also be maintained.

General Electric, too, is facing the facts . . . and the future.

**GENERAL ELECTRIC**

# Highways of Safety

## . . . . by Slater

More than 57% of the traffic deaths in the United States last year occurred during the hours of darkness, proving that the essence of highway safety lies in better lighting. Proper and sufficient lighting on the busy highways of the nation saves lives and money and speeds the shipments of vital materials from source to use. Slater Lamps are contributing to night safety and greater maintenance savings on thousands of miles of modern highways. From Portland, Oregon to Providence, Rhode Island, many cities are changing to the use of Slater Lamps for street lighting, traffic lights, fire alarms, one-way arrows, etc. Naturally, there's a reason. Slater Lamps are durable, sturdy, economical in cost and high in lighting efficiency—they deliver more lumens per square foot at less cost. That's why the city of New York uses them exclusively. New York's West Side Express Highway, shown above, is flooded with light from Slater Lamps. We'd like to tell you more about the savings you can effect by changing to Slater Lamps. Send today for complete details.

**OUR ENGINEERING DEPARTMENT WILL BE GLAD TO HELP YOU WITH YOUR LIGHTING PROBLEMS.** ***Write for complete information.***

*"Slater Lamps Scintillate"*

**Slater Electric & Mfg. Co., Inc.**

*Manufacturers of Street Lighting Lamps*

728 ATLANTIC AVENUE BROOKLYN, N. Y.

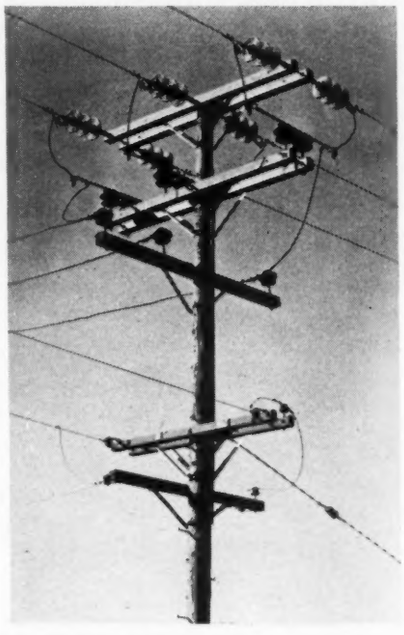
## Pole Lines

# Line Sectionalizing By Use of Hot Tap

By **FRANCIS CURTIS**
California Electric Power Company, Riverside, Calif.

In order to provide sectionalizing facilities without the cost of installing two 33-kv. line-sectionalizing switches. the California Electric Power Company has been employing hot tap connectors on some of its more recent rural lines. As shown in the accompanying picture, a typical installation consists of six hot tap connectors of the type manipulated by a hookstick which are attached to a short bus provided with "stirrups." This is mounted below the 33-kv. line, and in this instance above a tap line to a rural substation.

When operating conditions require



**INSTALLATION of hot tap connectors used for sectionalizing a 33-kv. rural line at point where it is tapped to a rural substation**

maintenance work on the line, three connectors are disconnected from one end of the bus and transferred to the disconnected line conductors. Service is then maintained to the rural substation from the other source through the remaining set of connectors into the tap line. No attempt is ever made to break a parallel or load current by means of hot tap connectors.

# *Value* FOR CUSTOMERS

# FLEUR-O-LIER LABEL!

mechanical safety, ease of maintenance, efficient lighting performance and many others.

## Ballasts and starters Certified!

Assures important high power factor (over 85%) and reliable, economical, balanced operation.

## Every unit guaranteed— wide variety!

Every unit built carries the FLEUR-O-LIER Manufacturer's guarantee. FLEUR-O-LIERS are made in over 100 different types, sizes and designs to fit specific industrial and office needs . . . an amazingly wide choice which helps assure your customers of getting CERTIFIED fixtures tailored to the job!

## Pre-sold prestige through continuous advertising!

Our national advertising hammers away week in, week out, in such important large circulation magazines as SATURDAY EVENING POST, TIME, NEWSWEEK, BUSINESS WEEK, UNITED STATES NEWS and other trade and business publications ...building FLEUR-O-LIER acceptance. Tells your customers the advantages of getting not only Certified FLEUR-O-LIERS, but getting helpful advice from your own lighting experts when planning an installation.

## Specify fixtures with the FLEUR-O-LIER label — the recognized mark of high quality.

It's a badge of honor on a fixture . . . definite assurance of 50 safeguards that protect you and your customers.

Write or use the coupon to get your FREE copy of the new booklet, "50 Standards for Satisfaction."

**In quantities for use by lighting men, etc., you can get them at cost —5c per copy.**

**Perhaps you may get these advantages in other fixtures;**
***YOU CAN BE SURE OF THEM ALL IN FLEUR-O-LIERS!***

**CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING**

who complies with FLEUR-O-LIER requirements

***TEAR OUT AND MAIL***

**Fleur-O-Lier Manufacturers**
**2126-3 Keith Building, Cleveland, Ohio**

Please send me FREE new booklet "50 Standards for Satisfaction," together with list of Fleur-O-Lier manufacturers.

Name _____

Address _____

City _____ State _____

# LOAD BUILDING

## What Advertising Policy for 1942?

For the utility sales executive who has been wondering what topics should be covered by his advertising during 1942 which would be consistent with the nation's war effort, a number of answers are provided in reproductions of advertisements which are carried in the Reddy Kilowatt *News*.

Savannah Electric & Power Company stresses the war effort and then points out that due to the efficiency and foresight of the power industry, non-defense use of electricity has not been seriously curtailed, that there is power and plenty "for welding tanks and making the morning toast and coffee."

Pennsylvania Edison Company is running advertisements which suggest repairing appliances and states also that the company does not ask the customer to give up using any electric appliance. It does suggest that lights not be left burning when no one is using them, that the radio doesn't run when no one is listening to it, and that other appliances are used efficiently.

The United Electric Light Company in Massachusetts announces that it is continuing its cooking schools, to be known as Victory Cooking Schools, "to acquaint the public with many economies in the preparation of good, wholesome food for the home."

Southern Colorado Power Company refers to the "Food for Victory" theme of the Secretary of Agriculture and then suggests that customers put cheap electricity to work in the house, in the barn and in the shop so that the farmer will have many more hours for planting, cultivating and harvesting crops.

Hartford Electric Light Company makes it plain that "there is enough electricity in Hartford for Victory factories and domestic uses. Use your electric appliances to save time, strength and energy for the important work that you have to do. Use electricity in every practical way." Other copy in the advertising suggests that electrical fixtures be kept clean and washed with soap and water. A repair service for appliances is stressed and the company states that the electrical dealers in Hartford are newly equipped and skilled to do the repair work which previously might

## How Glare Barrage Works

**In this example of anti-sabotage lighting, luminaires with Fresnel lenses are mounted on posts several feet away from the plants to be protected and aimed so that light is projected slightly downward away from the buildings. Guards posted behind the lights (left photo) see intruders clearly, but the saboteur sees only glaring spots of light. Photos by Westinghouse**

## This new and finer kind of light is sending America's production curves upward

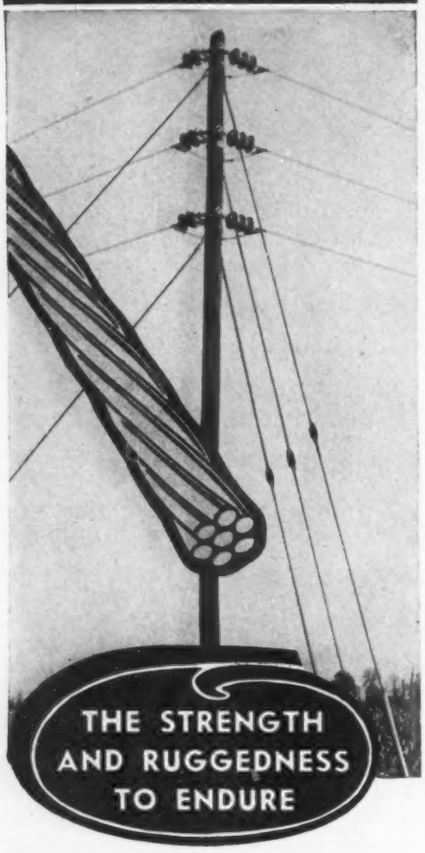
The finest artificial light in the world is at America's service. Already thousands of workers' eyes see more clearly, skilled hands work faster under the cool, bright, pleasant light of Westinghouse Mazda Fluorescent Lamps.

Many of the engineering refinements that make these modern fluorescent lamps more practical and dependable resulted from the years of experience Westinghouse has gained in making quality lamps. And, you can look to famed Westinghouse Mazda Research for still greater advancements and continued superiority in the future. Westinghouse Electric and Manufacturing Company, Lamp Division, Bloomfield, N. J.

*For More Top-Quality Lighting Installations—*

**Westinghouse MAZDA FLUORESCENT LAMPS**

Crapo
GALVANIZED STEEL
STRAND




**STRENGTH** to support the pole structure under maximum ice and wind loading ... **RUGGEDNESS** to withstand the punishment incurred in construction and service .... **DURABILITY** that outlasts the normal life of the line .... are combined---with important **ECONOMY**---in *Crapo* Galvanized Steel Strand.

Each size and grade develops the full tensile strength of the steel in cross section. The heavy, ductile, tightly-bonded zinc coating---applied by the famous *Crapo* Galvanizing Process---provides lasting protection against corrosion.

There is a size and grade of *Crapo* Galvanized Steel Strand for every practical need. Consult the distributor of *Crapo* Galvanized Products near you or write direct for further information!

INDIANA
STEEL & WIRE CO.
MUNCIE, INDIANA

have been considered impractical.

Nebraska Power Company ties together good lighting and civilian defense work, while Duke Power Company is urging appliance repairs until new appliances are available, after the needs of defense are taken care of.

•

## Educational Effort by K. G. & E.

Except for reducing excess stocks of goods, Kansas Gas & Electric Company, Wichita, has not been actively promoting appliances since last November. This year's program contemplates principally an educational effort involving what the company calls "Customer Service Calls."

These calls by residential and commercial representatives will have as their objectives (1) aiding the war effort by giving maximum attention to service problems in defense areas; (2) aiding and education for the repair of inoperative appliances and conservation of those devices in good condition; (3) redistributing second-hand appliances that have no value to present owners; (4) explaining possible inconvenience which may arise out of priority restrictions or power rationing; (5) selling future use of electric service for the post-war period; (6) keeping customers informed with respect to the company's service.

## Food Conservation Aim of New Orleans Ads

Daily reports to New Orleans housewives on available surplus food commodities, their preparation and conservation through canning are part of a new service that New Orleans Public Service Inc., is rendering to customers through newspaper and radio media.

Undertaken to further wartime conservation, this service helps customers stretch their food budgets by purchasing food products in season when they are cheap and plentiful and conserving them for later use through proper canning methods.

Marketing information is supplemented by tested recipes for preparing and canning the various foods. Housewives who *already* own ranges are told how to use them to best advantage for this work but no attempt is made to encourage purchase of new appliances.

Proper use and care of existing equipment will be featured in future activities.

These daily market and food preparation "reports" are replacing promotional and appliance advertising, which has been discontinued for the present, in cooperation with the government.

Information on available surplus foods used in the daily reports is gathered by the company's economists in trips to various food marketing centers and from bulletins such as;

**BROADCASTING** from New Orleans Public Service auditorium, Martha Adams (left) and Sue Collins (right) give market information on surplus foods and modern cooking methods

(1) Agriculture and Market service, U. S. Department of Agriculture, (2) Surplus Marketing Administration, U. S. Department of Agriculture, (3) Fish and Wild Life Bulletin, U. S. Dept. of Interior, (4) State Dept. of Agriculture and (5) Local wholesale food organizations. The material developed is used in the preparation of low-cost menus and recipes.

In the daily shopping tour calls are made on (1) wholesale food markets, (2) meat packers, (3) wholesale fish markets, and (4) independent and chain grocery stores. These calls frequently develop newsy bits of information on local products and delicacies that are available in quantity for a limited time.

In addition to regular newspaper channels, women's club meetings and cooking schools this market information is broadcasted daily over New Orleans radio station WWL as part of Martha Adams Kitchen radio program directed to an audience of housewives who have come to rely on Martha Adams and her friend Sue Collins for information about cooking and household problems. This program is broadcast from the auditorium of New Orleans Public Service Inc.

•

## How to Care for Electrical Appliances

An up-to-date summary on the testing of household equipment, their care and remedies when the appliances do not operate properly, is contained in a booklet on home electrification, issued by R. U. Blasingame of Pennsylvania State College.

A summary of various tests on household equipment has been written in a simplified form which may easily be assimilated by the housewife.

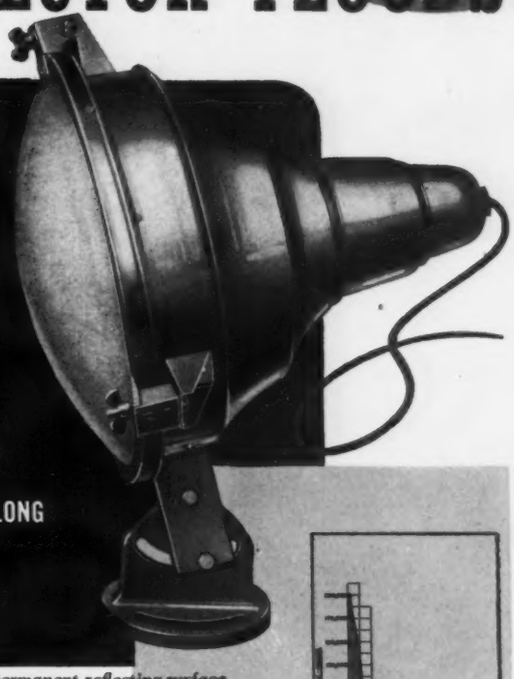
The section on the care of electrical appliances deals in general with cleaning, oiling and adjusting. The appliances covered are the electric range, refrigerator, ironer, vacuum cleaner, and a host of small home appliances.

Another important section is devoted to questions and answers and describes the causes for most of the common minor failures which occur from time to time in certain types of popular electrical home equipment.


Protect INDUSTRIAL MIGHT with a RING OF LIGHT FROM PERMAFLECTOR FLOODS

New

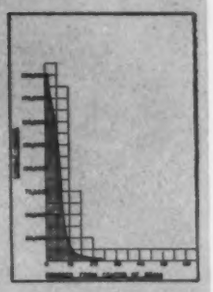
- RUGGED, WEATHER-PROOF CONSTRUCTION
- CORROSION-RESISTANT TREATMENT
- *PERMAFLECTOR ENGINEERED, CONTROLLED LIGHT
- FOUR WATTAGES; THREE LIGHT DISTRIBUTIONS—CLOSE, INTERMEDIATE AND LONG RANGE SERVICE
- LIGHT WEIGHT – EASIER HANDLING



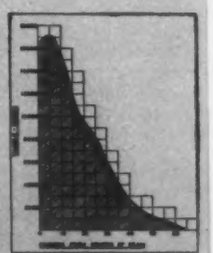
*The silvered glass reflector with the permanent reflecting surface.

Minimum of Critical Materials Used

Combat sabotage and maintain production schedules with these new enclosed Permaflector Steel Floodlights. These units are designed as illustrated above; are complete, ready to install; and consist of a spun steel case equipped with hinge and clamps, heat-resisting cover glass, cast iron base, wire cord grip fitting, three-foot length of rubber-sheathed duplex wire, mogul socket and a Permaflector, the silver mirrored glass reflector which provides engineered light control from extreme concentration to extra broad spread. Completely weather-proof and corrosion-resistant, these floodlights are ideal for all outdoor floodlighting applications. They may be mounted on a vertical or horizontal surface or attached to a pipe and adjusted to almost any position. Avoid delay, send in your inquiry or order today and obtain prompt delivery.



Concentrated Distribution Floodlights Nos. ST-1150-C, ST-1110-C. Addition of Stippled Cover Glass Provides Narrow Distribution.



Broad Distribution of Floodlights Nos. ST-1050, ST-1010.

APPLICATIONS
Air Fields
Army Posts
Factories
Railroad Yards
Shipyards
Dams
Bridges
Reservoirs
Power Stations

| Cat. No. | Cover Glass | Incandescent Lamp | Distribution |
|---|---|---|---|
| ST-1050 | Stippled | 500-300 watts | Broad |
| ST-1150 | Stippled | 500-300 watts | Narrow |
| ST-1010 | Stippled | 1000-750 watts | Broad |
| ST-1110 | Stippled | 1000-750 watts | Narrow |
| ST-1150-C | Clear | 500-300 watts | Concentrated |
| ST-1110-C | Clear | 1000-750 watts | Concentrated |

Standard Quantity—1 Approx. Net Weight Each—35 lbs.

PITTSBURGH REFLECTOR CO.

403 OLIVER BLDG
PITTSBURGH, PA.

PITTSBURGH REFLECTOR CO. EW-3-42
403 Oliver Building
Pittsburgh, Pa.

Please rush complete data on Permaflector Enclosed Floodlights.

Name.....
Firm.....
Address.....

# NEW EQUIPMENT

## Blackout Street Light

Luminaire which produces light equivalent to that from the flame of a single candle has been developed for use during possible air raids or other emergencies when the regular street and highway lights must be put out. The unit is painted black. It has a 10-watt incandescent lamp concealed so that the only illumination visible is through a narrow, circular piece of plastic around the side. After the eye becomes adjusted to the darkness persons or objects can be seen at distances of 30 to 40 ft.

Blackout street light; produces a spead of light equal to starlight or 0.01 of moonlight when spaced 100 ft. apart and mounted 15 ft. above the street, based on specifications used by the British in their blackouts. **General Electric Co.**, Schenectady, N. Y.

•

## Paint

Camouflage paint; standard colors such as light and dark green, loam, sand, field and olive drab, and earth brown, red, and yellow. **Sherwin-Williams Co.**, Cleveland, Ohio.

For concealing strategic military and civilian objectives, new camouflage paints are said to dry without gloss or reflection and to adhere to practically any type of surface from glass to asphalt roofing. Colors are according to color standards established by U. S. Army and are said to meet requirements of the Office of Civilian Defense. Company executives point out, however, that no camouflage painting should be undertaken until authorized by the local director of camouflage.

## Glare Shield

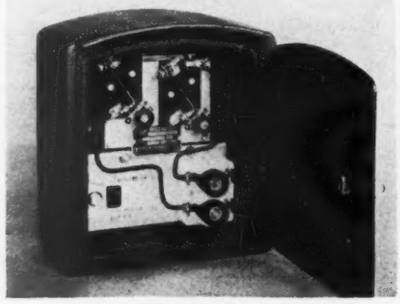
"Louverplas" glare shield; available in flat sheets and in formed panels. **The Doane Products Corp.**, Meriden, Conn., and **Ivan T. Johnson Co., Inc.**, 95 Madison Ave., New York, N. Y.

A non-fragile cellulose acetate plastic designed for use with fluorescent lamps is said to reduce hazards of flying glass splinters such as resulting from air raid bombings. Prismatic finished panels are designed to eliminate glare and lower the surface brightness of fixtures to the recommended foot-lamberts. Shields with black louvers will, it is claimed, completely blackout the light source at certain angles, depending upon the position of the louvers to the light source; suitable for critical inspection tasks.

•

## Coding Control

To indicate air raids and blackouts, a motor-driven coding control has been developed for use with sirens, alarms, etc. Its action is automatic and it has two signals; one signals a series of alarms in 15 cycles of raising and lowering tones during a period of two minutes, the other signals a steady "all clear" siren blast for two minutes. It is supplied with automatic cut-off and push-button start and can be furnished in weatherproof cabinet.

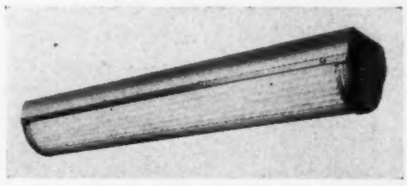


Motor-driven coding controls; 110 volts, 60 cycles. **Reynolds Electric Co.**, 2650 West Congress St., Chicago, Ill.

**BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.**

## Fluorescent Luminaire

Designed especially for semi-direct or direct illumination for commercial applications, new luminaire has semi-cylindrical section of fluted Alvax glass which diffuses the light. Lamp starter and either single or two-lamp ballasts provided.

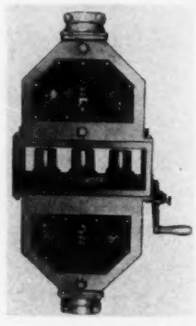


Type "CL-110" fluorescent luminaire; available for continuous row ceiling or surface mounted, individual ceiling or surface mounted and suspension mounted units. **Westinghouse Elec. & Mfg. Co.**, East Pittsburgh, Pa.

•

## Junction Box

Two three-conductor pothead bodies and an isolator mounted between them constitute a junction box. Upper and lower bushings of isolator extend within the pothead bodies. Isolator replaces customary disconnecting links and its cabinet can be inclosed with transparent moisture proof cover for manhole installation.



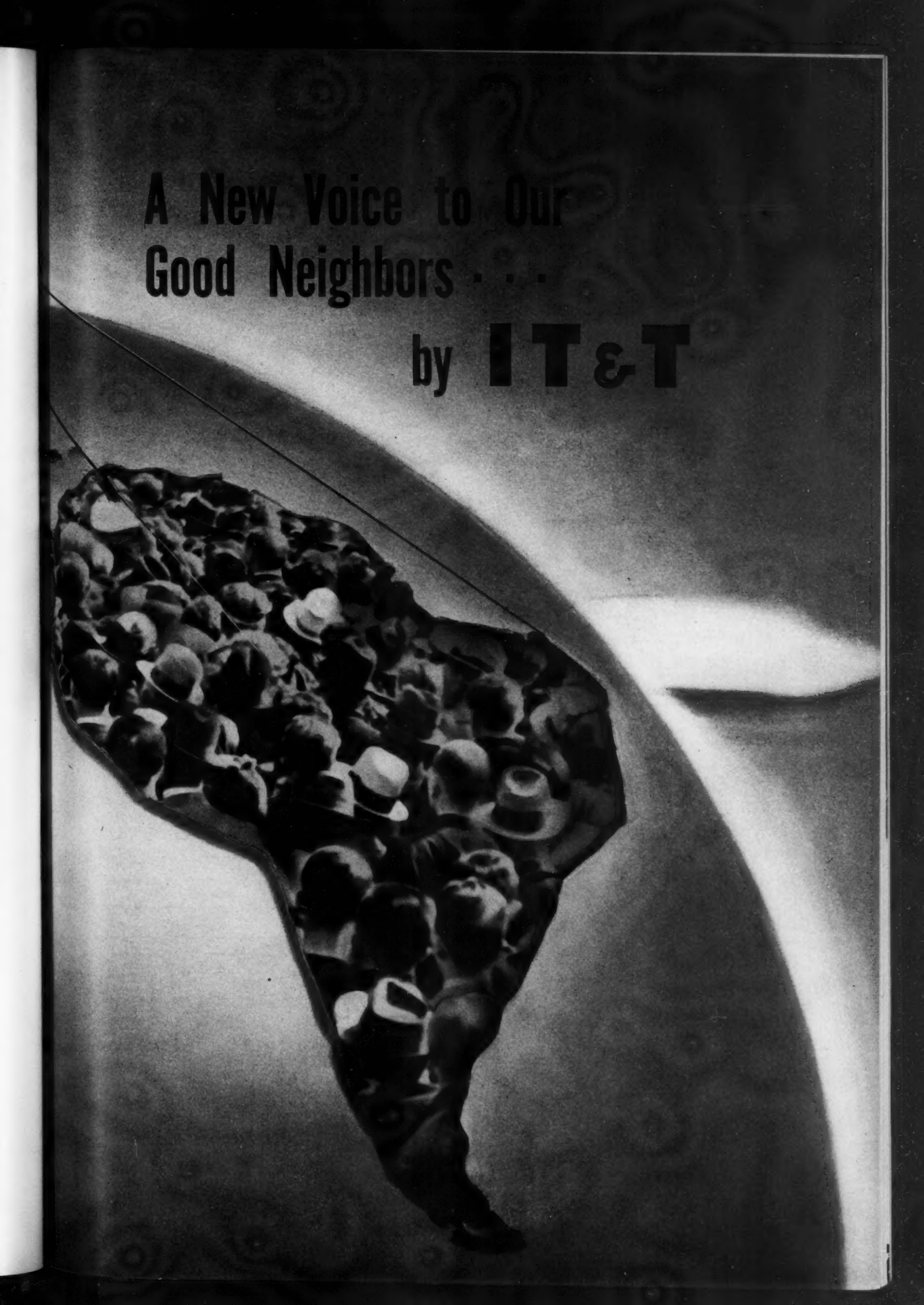
Three-conductor two-way junction box; ratings, voltages 5,000 to 15,000, amperes 200 to 1,200, illustrated 5 kv. 200 amp. **Electrical Engineers Equipment Co.**, Melrose Park, Ill.

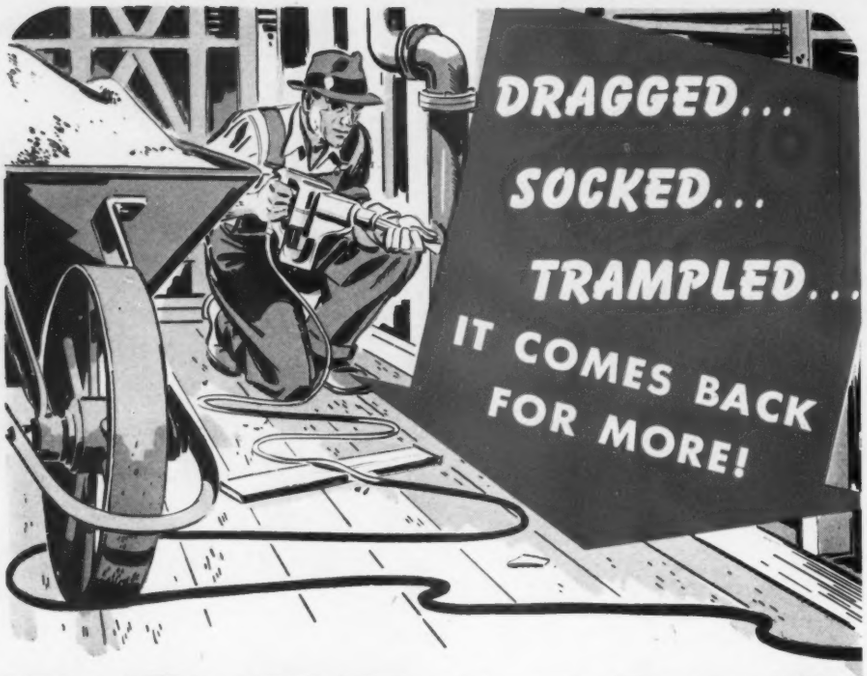
•

## Transformers

Indoor air-cooled power circuit transformers; capacities 25 to 150 va. inclusive, 230, 460, and 575 volts primary, 115 volts secondary. **Jefferson Electric Co.**, Bellwood, Ill.

Additions to line of power circuit transformers includes larger sizes which are said to be self-contained, equipped with roomy wiring compartment for primary and secondary connections and insulated for safety. They may be used for individual lighting on production machines and for


A New Voice to Our
Good Neighbors . . .
by IT&T




# ROEBLING

*Plain Rubber*

## PORTABLE CABLES AND CORDS

It takes a tough hide to stand up under the abuse of being jerked around, dragged through mud, over rocky ground, even under cars and trucks. But Roebling Portable Cables and Cords have proved themselves in just that kind of service—on electric shovels, air compressors, tools and other portable equipment.

First, they have flexible rope-laid conductors—that mean ease of reeling or handling. Then they are carefully insulated with a tough, high grade rubber. And finally, they get an outer jacket of tough, abrasive and moisture-resistant rubber compound.

ROECLAD—This type has rubber fillers and a heavy twine reinforcing braid between the core and tough rubber jacket. For *exceptional* resistance to impact and crushing.

ROECABLE—This type has jute or other fiber fillers served with rubber filled tape under the tough rubber jacket. For extra flexibility, but less resistance than ROECLAD to impact and crushing.

Both types furnished with or without ground wires, with or without shielding as specified. Inquiries should be referred to our nearest office.

### OVER 60 OTHER TYPES

of Roebling Electrical Wires and Cables are made in our mills under complete Roebling supervision and inspection—from copper bar to final reeling or spooling. They include: Power Cables, Bare Wire and Strand, Building Wire, Portable Cords and many others.

JOHN A. ROEBLING'S SONS COMPANY

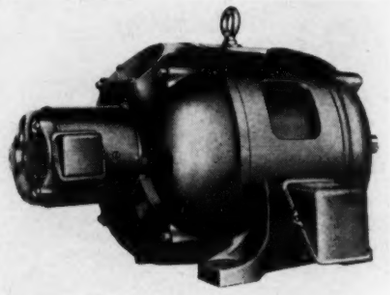
TRENTON, NEW JERSEY • Branches and Warehouses in Principal Cities

operation of small electrical devices, such as motor-driven equipment, magnets, control, and relays.

•

## A. C. Generators

Line of new, compact, stream-lined, revolving field a.c. generators offered by the company are built to meet AIEE and NEMA voltage regulation standards. They



Revolving field a.c. generators; sizes, 7½ to 75 kva., 1,800, 1,200 or 900 r.p.m., 60 cycles, corresponding speeds for other frequencies, standard voltages, single, two and three-phase, two, three and four wire. **Century Electric Co.**, 1806 Pine St., St. Louis, Mo.

can be designed for any desired value of power factor, but the regulation will be governed by the power factor. They can be arranged for belt or coupling drive or flange mounting.

•

## Insulation

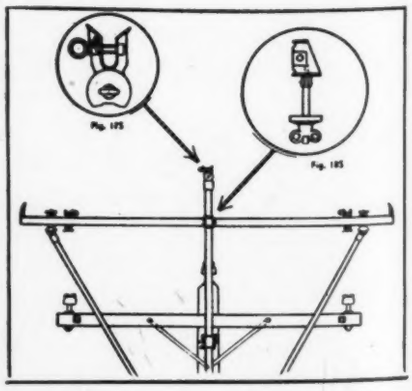
Fibronized "Koroseal" tubing; available in A.S.T.M. sizes and in a variety of colors, including a transparent shade. **Irvington Varnish & Insulator Co.**, Irvington, N. J.

New electrical insulation is said to have resistance to acids, alkalis, solvents and heat, to be fireproof, and to retain its flexibility. Manufacturer states that it has a tensile strength of 2,845 lb. per sq.in., a dry dielectric strength (0.022-in. wall thickness) of 1,050 vpm., and a wet dielectric strength (0.022-in. wall thickness) of 817 vpm. after 24 hours immersion.

•

## Arm Fittings

New arm attachments are designed to make possible the adjustment of a conductor lift, to fit any ridge-pin structure so that all conductor holders will engage all conductors at the same time and lift them in one operation.



"Fig. 175" "Fig. 185". Tips auxiliary arm fittings. **A. B. Chance Co.**, Centralia, Mo.

# MANUFACTURING-MARKETS

## Refrigerator Sales Rise; Ranges Drop

Domestic sales of electric household refrigerators during the month of January amounted to 126,431 units, compared with 91,787 units in December, 1941, and with 349,901 units in January, 1941, according to the report issued by the National Electrical Manufacturers Association. Exports including those to Canada totaled 4,815 units in January, compared with 13,657 units in January, 1941, bringing world sales for the month to 131,246 units, compared with 363,558 for the similar month of 1941.

Sales of electric ranges to continental United States, Alaska and Hawaii totaled 30,196 units in January, compared with 50,516 units in January, 1941. In December, 1941, range sales amounted to 48,705 units.

•

## Give Coffin Fellowships

Fellowships have been awarded by the Charles A. Coffin Foundation to five graduates of as many colleges and universities, W. W. Trench, secretary of the foundation and also of the General Electric Co., which created the foundation in honor of its first president, has announced. These fellowships, granted annually, enable outstanding graduates to continue or undertake research work in educational institutions either in this country or abroad. This year seventeen applications for the fellowships were made. The fields in which awards are made include electricity, physics and physical chemistry.

•

## Square D Plans Addition to Kollsman Division

A plant addition, which will substantially increase the production of precision flight instruments and optical aircraft equipment by Square D Company, has been announced by F. W. Magin, president.

"This new plant anticipates the increased requirements of the President's new plant-building program and we are planning still further expansion to avoid any possible bottleneck in aircraft instruments for national defense," Mr. Magin stated. The new plant is being built by the Defense Plant Corporation, which will lease it to Square D with an option to purchase. The five-story reinforced concrete building will cost approximately $500,000; the machinery and other equipment will cost in excess of $200,000.

•

## Moves Acoustic Division

Burgess Battery Co. has announced that its acoustic division will move to 2815 West Roscoe St., Chicago, effective March 30.

## Westinghouse Makes New Records in '41

In the annual report to stockholders recently issued Westinghouse Electric & Manufacturing Co. disclosed that engineering accomplishment in 1941 exceeds that of any previous year. This was accelerated by its effort in the country's war activities.

New records were made in volume of incoming orders, amount of sales billed, volume of unfilled orders, number of employees at the end of the year, and total payroll for the year.

Net sales billed amounted to $369,094,124 in 1941, an increase of 54 percent over the 1940 billings of $239,431,447. Orders received amounted to $582,808,634, compared with $400,477,742 in 1940, an increase of 46 percent. This figure does not include orders placed for production at ordnance plants the company is operating for the Navy.

Net income during the year was $23,-

**LIGHT TOUCH AT G.E. MEETING—General Electric used this bevy of beauties to impress upon 60-cycle engineers that newest high-frequency equipment can be employed to see, hear, taste, touch and smell. Story in "Electrical World," March 7, 1942, page 72**

**● Osmoplastic treatment prevents groundline decay thus increasing standing pole life.**

In these critical times, it is important that poles keep standing longer to avoid power failures. You can guard against pole failures due to groundline decay by using the Osmoplastic groundline treatment. This easy to apply wood preservative increases standing pole life by 7 to 10 years. In addition, frequent pole inspection is eliminated. Osmoplastic groundline treatment is economical, too. Service records of over 60 leading utilities compiled from over a million Osmoplastic treated standing poles prove Osmoplastic pays. Make inspection time Osmoplastic time for lowest cost pole protection.

***SEND coupon below for full information***

**OSMOSE**
**WOOD PRESERVING COMPANY**
Buffalo, New York

Osmose Wood Preserving Company
Buffalo, New York
Please send me complete data on the Osmoplastic groundline pole treatment.

Name_____

Company_____ Title_____

Address_____

City and State_____


117,510, compared with $18,985,428 in 1940, an increase of 22 percent. This represents $7.21 per share of capital stock outstanding at the year end. Accrual for depreciation, obsolescence, and replacement of buildings and equipment during the year 1941 amounted to $7,518,518, as compared with $5,952,414 in the year 1940. At December 31, 1941, current assets amounted to $248,902,598, current liabilities, $85,957,929.

"The affairs of the company will be governed by the needs of the Nation in time of war," A. W. Robertson, chairman, and G. H. Bucher, president, stated in the report. "There is no reason to anticipate any difficulties other than those experienced by other companies in a similar position, but stockholders should realize the management of the company must necessarily be responsive to the needs of the country . . ."

•

## Crocker Wheeler Has Record Year in '41

Crocker Wheeler Electric Manufacturing Co. has announced to its stockholders in the annual report just issued that 1941 was the biggest year in the history of the company.

Orders booked during the year totaled $8,040,672, an increase of 233 percent over the previous year.

Net income before deducting provisions for federal income tax and general contingencies amounted to $971,824; after deductions for federal income tax and general contingencies net income totaled $731,562.

As of December 31, 1941, the company reports a surplus of $222,157; as of December 31, 1940, it reported a deficit of $509,405.

• •

## Moves Norfolk Offices

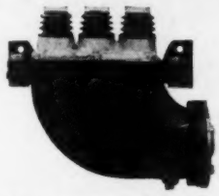
Graybar Electric Co., Inc., has announced the removal of its Norfolk branch office to a more convenient location for customers in that area. The new warehouse and offices, located at 21st Street and Debree Avenue, contain a separate entrance for loading and quick contractor service, larger warehouse space, counter and display room and ample parking space for pick-up customers.

### New York Metal Prices

| | March 17, '42 Cents per Pound | March 11, 42 Cents per Pound |
|---|---|---|
| Copper electrolytic | 12.00* | 12.00* |
| Lead, A. S. & R. Price | 6.50 | 6.50 |
| Antimony | 14.00 | 14.00 |
| Nickel, Ingot | 35.00 | 35.00 |
| Zinc, Spot | 8.64 | 8.64 |
| Tin, Straits | 52.00 | 52.00 |
| Aluminum, 99 percent | 15.00 | 15.00 |

* Delivery Connecticut Valley.


**ELECTRICAL SPECIALTIES**
**FOR HEAVY-DUTY POWER SERVICE**
RMC



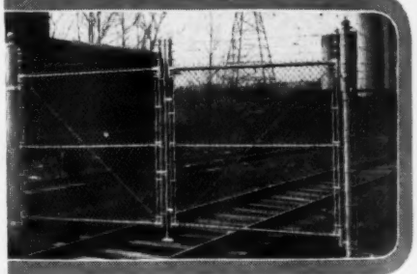
For over a quarter of a century, Rusgreen has been making Potheads and special items, built to the most exacting requirements. Bring your electrical problems to Rusgreen . . . today!

ENDULATORS (POTHEADS) ALL SIZES • ALL SHAPES • ALL VOLTAGES • ALL TYPES • BUS SUPPORTS • SPLICING KITS AND MATERIALS • INSULATING COMPOUNDS

★ ★ ★

**RUSGREEN MFG. CO.**
14260 Birwood Avenue • Detroit, Mich.

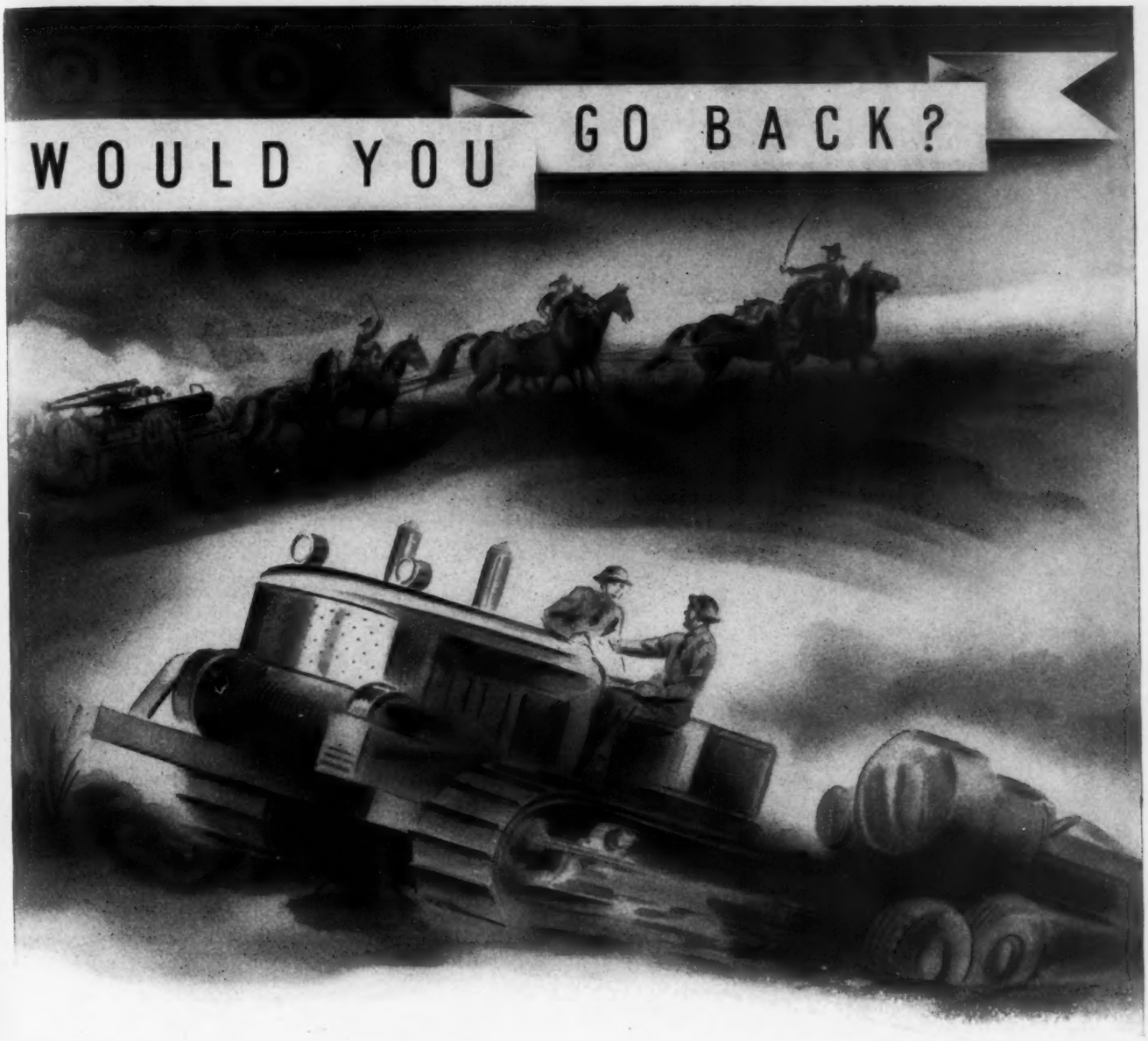
**IS YOUR PROPERTY *a set-up* FOR SABOTEURS?**



Unfenced utilities property invites trouble, and in times like these you just can't afford to take chances. Surround your property with a Stewart Non-Climbable Chain Link Wire Fence—a barrier of steel that assures continuous, unfailing protection. Fence NOW—next month may be too late! Send for Catalog I-41 showing typical fence installations and details of other iron and wire accessories for industrial use. Sales and erection service in principle cities.

**The Stewart Iron Works Co., Inc.**
964 Stewart Block Cincinnati, Ohio
*"Fence Builders to America Since 1886"*

Stewart IRON and WIRE FENCES




# A BETTERMENT . . .

## *Not a Substitute*

What General would consider the Modern Motorized Artillery as a temporary substitute for the slow . . . old-time . . . horse-drawn cannon?

Changing times . . . changing conditions . . . demand new and better tools and materials.

"All-out" wartime production has made many materials hard-to-get. Manufacturers today are thinking in terms of replacing habitually used corrosive-weighty-costly materials, now hard-to-get with NON-metallics.

Many of these change-overs will so improve products . . . and will be found to be so superior to the materials formerly used . . . that designers never will go back to the "horse-drawn cannon days."

Furthermore, a golden opportunity now exists for designers and engineers in C-D NON-metallic products . . . and can *now* do so with full approval of management.

C-D can offer all such engineers an unique service. C-D makes *not* just one or two types of NON-metallics but FIVE distinctly different NON-metallic materials. C-D is, therefore, able to make and recommend the best NON-metallic material for a specific problem. Write today for Booklet GF-12 . . . "What Material?"

**Continental-Diamond FIBRE COMPANY**

*Established 1895 . . Manufacturers of Laminated Plastics since 1911* — NEWARK • DELAWARE

# L-M Connector now stronger than ever

The L-M Connector is better now than ever. Its body of a new cast bronze alloy, machined all over, gives exceptional high strength and adds years of usable life.

Accurate overall machining results in perfect threads which give remarkably high pressure contact between conductors with low applied wrench force. Machining also gives the smooth surfaces and rounded corners which protect the conductor and make the connector easy to handle. The wide surfaces and V groove pad insure good current carrying capacity and prevent slippage.

On your next order specify L-M Connectors.

LINE MATERIAL CO.
MILWAUKEE, WIS.


# Field Reports on Business

*Orders for industrial electrical equipment continue in good volume, with central-station apparatus moving steadily. Merchandise sales are active, but stocks are diminishing rapidly. Defense housing is going forward on a large scale and considerable electrical supplies and equipment are included.*

## NEW ENGLAND

Boston Elevated will buy 100 new trolley cars to meet war traffic demands at an estimated cost of $1,750,000. Orders for industrial electrical equipment continue in good volume. Bookings of copper wire and cable have stepped up recently. Motor-generator sets are very active and pumping units for marine needs are among leaders in defense equipment purchases. Central station apparatus is moving steadily; an Allis-Chalmers oil circuit breaker order amounting to about $20,000 was recently closed here, and small lot orders for materials for plant service extensions are encouraging. Some pole line supplies are being bought. Vermont Electric Cooperative, Eden Hills, has been allocated $35,000 to complete a section of its system.

An increasing number of small plants in this area are receiving war orders. Electric clock manufacturers report steady government bookings. Portable plug-in motor sirens from ⅓ hp. up are selling well and orders aggregating $2,000 were noted during the past week.

Federal Communications Commission has received an application from the Outlet Co., Providence, R. I., for permission to construct a new high-frequency broadcasting station. Additional facilities at the South Boston naval drydock costing $1,200,000 will be constructed by Morton C. Tuttle Co., Boston. The contract for a new veterans' hospital in West Roxbury has been awarded to John Bowen Co., Boston, for $1,331,000 and includes electric elevators and complete electric cooking installations.

Public Service Co. of New Hampshire's appliance sales totaled $875,141 in 1941, against $592,421 in 1940. Sales continue ahead of last year, but merchandise stocks are diminishing rapidly.

## CHICAGO

Although many plants in this area are working at capacity, definite action has been taken by Chicago ordnance officials to implement a program for spreading war contracts into small business channels. A survey is being made to ascertain the plant and tool facilities available in order to speed output of war materials and at the same time benefit many firms whose production has been curtailed by the war program.

Col. Donald Armstrong, chief of the Chicago Ordnance District, reported that contracts awarded to date were in excess of $1,400,000,000 and within the next few months the amount would be increased to over 2 billion dollars. During the first seven months of 1942 $26,820,000 was spent for construction of new plants and additions in Chicago.

Ilg Electric Ventilating Co. and the Breuer Electric Manufacturing Co. are expanding facilities to meet the heavy demand for fans, blowers, motors, heater units and industrial vacuum cleaners.

Of 29 manufacturers reporting February sales to the Electric Association, ten showed an increase, while nineteen had a decrease. Compared with February last year, nineteen had an increase and ten showed a decrease. All of the electrical wholesalers reported gains over both the preceding month and a year ago.

Orders awarded for electric equipment included Delta-Star Electric Co., switchboard, $12,211; General Electric X-Ray Corp., one million-volt X-ray set, $31,050, and traveling crane, $5,127.

## NEW YORK

Estimates of over-all industrial activity for the current month are now being revised sharply upward in the face of evidence that output in war factories is mounting speedily, according to the New York *Journal of Commerce*. Conversion to war production is proceeding at a swifter pace than had been anticipated.

Engineering construction volume last week totaled $133,267,000, an increase of 0.5 percent over the corresponding 1941 week, but 8 percent lower than the volume reported for the preceding week, *Engineering News-Record* reports. Public construction topped the corresponding week last year by 8 percent, but was 2 percent below the preceding week. Private work was 41 and 44 percent lower, respectively, than a year ago and during the preceding week. The week's construction brought the 1942 total to $1,542,271,000, a gain of 24 percent over the $1,245,406,000 reported for the eleven-week period in 1941.

While retail sales are declining from the levels of the period of the rush buying, purchases are being made well in advance of actual needs.

## PACIFIC COAST

Manufacturers and wholesalers report another big month for all appliances, helped by what are probably among their last shipments from their factories. It is predicted that April will see peak of sales shifted to dealers, with a sudden cessation by June. February building permit figures for the seven Western states show 25 percent total increase over January, 1942, but 40 percent decrease from February, 1941.

Pacific Gas & Electric Co. reports no curtailment of service in its 89,000 square miles of territory in northern and central California despite heavy war demands for industries and housing. Tacoma is in the market for 1,250,000 lb. 350,000-cir.mil bare copper wire, 15,000 insulators, and steel towers for a 35-mile transmission line, and Los Angeles is requesting bids on turbines and generators for four new plants in the Owens River Gorge.

Several exceptionally large awards and bids for machinery are reported, including $150,000 for electric platforms at San Diego naval base, $202,968 for three Allis-Chalmers circuit breakers for Boulder, $822,610 for 36,000-kva. Westinghouse transformers for Coulee, $1,196,925 for ten 20,000-kva. Allis-Chalmers transformers for Longview, Wash.; four G.E. circuit breakers, costing $240,000, for Pacific Gas & Electric system, and $210,000 G.E. switchgear equipment and accessories for Moore shipbuilding plant enlargement. Southern Pacific is installing $300,000 new equipment in its West Oakland yard improvements and opens this week its 38.5-mile Shasta Dam bypass.

# SAVE MAN HOURS

## ...In Your Own Plant

### BENEFIT by MR. HILL'S EXPERIENCE

Have you checked lately to be sure that your production is not needlessly interrupted by electrical protective devices opening on ordinary harmless overloads, momentary high starting currents or other temporary current surges? . . . That this condition is not the cause of losing time, wasting money, creating unnecessary delays?

The correct answers to these questions are important to you—today, more than ever—because a fuse is THE vital link that keeps the circuit in operation and often holds the production line together!

#### If You Have "Shutdown Trouble"— This is How to Cure It

Take a page out of Mr. Hill's book . . . In your plant you can duplicate his experience—just as thousands of other operating executives have done . . . Speaking of the change to Buss Super-Lag fuses, he says, "It entirely eliminated the trouble we were having with needless blows . . . increased production . . . corrected a hazardous situation."

*Buss Super-Lag Fuses don't blow needlessly!* They provide ample protection on normal loads, plus the additional advantages of the Buss time-lag feature that prevents needless blows when harmless temporary overloads occur under ordinary operating conditions. It is this "delayed action" on reasonable overloads and normal starting surges that saves so many priceless man hours.

#### Good "Contact" and the Buss 10-Feature Fuse Case Also Reduce Outages

Poor contact is another cause of needless blows. This has been reduced to a minimum with the "10-Feature" Buss Fuse Case—designed to make and *maintain* good contact, as well as hold a fuse-link. When a Buss fuse is assembled or renewed, good contact is automatically made on the link—and is always maintained no matter how long the fuse is in service. This avoids overheating due to poor contact and consequent interruption from needless blows.

#### Protect Your Plant Against Shutdowns

Guard against avoidable delays, electrical hazards, shutdowns, lost man hours. Specify Buss Super-Lag Fuses wherever electrical equipment needs protection. Send for Bulletin Rcs.

BUSSMANN MANUFACTURING CO.
University at Jefferson,
ST. LOUIS, MISSOURI
*Division McGraw Electric Company*

# FUSES

# NEWS ABOUT PEOPLE

## Colonel Kelly Assumes New Executive Duties

Colonel William Kelly, president of Buffalo, Niagara & Eastern Power Corp., who recently was elected president of Buffalo Niagara Electric Corp.

(ELECTRICAL WORLD, March 14, page 17) joined Buffalo, Niagara & Eastern in 1926, after serving 27 years in the United States Army.

Following graduation at the head of his class from the U. S. Military Academy at West Point in 1899, Colonel Kelly was commissioned an officer in the Engineering Corps of the United States Army, serving through various grades in the Corps until 1928, when he resigned from military service. For his service in World War I, the American Government awarded Coloney Kelly the Distinguished Service Medal.

Following the War, Colonel Kelly served for five years as chief engineer of the Federal Power Commission and was appointed by the Federal government as a member of the Joint Board of Engineers, St. Lawrence River project. Going to Buffalo, Niagara & Eastern Power Corp. in 1926 as vice-president in charge of engineering, Colonel Kelly was appointed three years later to the position of vice-president and general manager and in 1933 he was elected president. Three years later he became president of Niagara, Lockport & Ontario Power Co.

He is a fellow of the American Institute of Electrical Engineers, a fellow of the American Association for the Advancement of Science, and a member of the Society of American Military Engineers and the Army Ordnance Association. He was made honorary member of the American Society of Civil Engineers last January.

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## H. R. Bacon Elected Head of Connecticut Utility

Harold R. Bacon has been elected president of the Derby (Conn.) Gas & Electric Co., succeeding Malcolm M. Eckhardt, who has retired after 40 years of service. Mr. Eckhardt is a native of Hartford, and after being graduated from Sheffield Scientific School of Yale University joined the company as an engineer in its street department in 1902. Two years later he became superintendent of the electric light department, and in 1925 was elected secretary and treasurer, becoming vice-president in 1933 and president in 1934. Mr. Bacon is also a Sheffield graduate and he entered the company's employ in 1924, later being made superintendent of its electric department. He was elected secretary in 1939, and vice-president in February, 1941.

•

▶ THOMAS BRAGG, vice-president of the Alabama Power Co., has been appointed by Gov. Frank Dixon as state salvage chairman and associate member of the State Defense Council. His duties will be to co-ordinate and supplement efforts already being made by Boy Scouts, school children and others to salvage waste paper, scrap metal and other materials.

## Nelson Elected President of Beaumont Properties

Roy S. Nelson, who was recently elected president of the Gulf States Utilities Co., Beaumont, Tex. (ELECTRICAL WORLD, March 14, page 4), entered upon his public utility career in 1915 when he became identified with the Blackstone Valley Gas & Electric Co., at Pawtucket, R. I. Early in 1917 he was assigned to the power station of the Connecticut Power Co., at Middletown, but later in that year he transferred his interests to Puerto Rico. At first he served in the power station of the Ponce Electric Co., subsequently becoming assistant engineer and later chief engineer of the company.

In 1920 Mr. Nelson returned to the United States, joining the Eastern Texas Electric Co., Port Arthur, Tex., occupying the position of assistant chief engineer and then of chief engineer. In 1923 he severed his connec-

tion with the Port Arthur properties to go to Kingston, Jamaica, as superintendent of the Jamaica Public Service Co., relinquishing these duties in 1930 to become manager, electric department, Virginia Electric & Power Co. in Richmond. He was elected president of

under thousands of
"heavy traffic" streets like this

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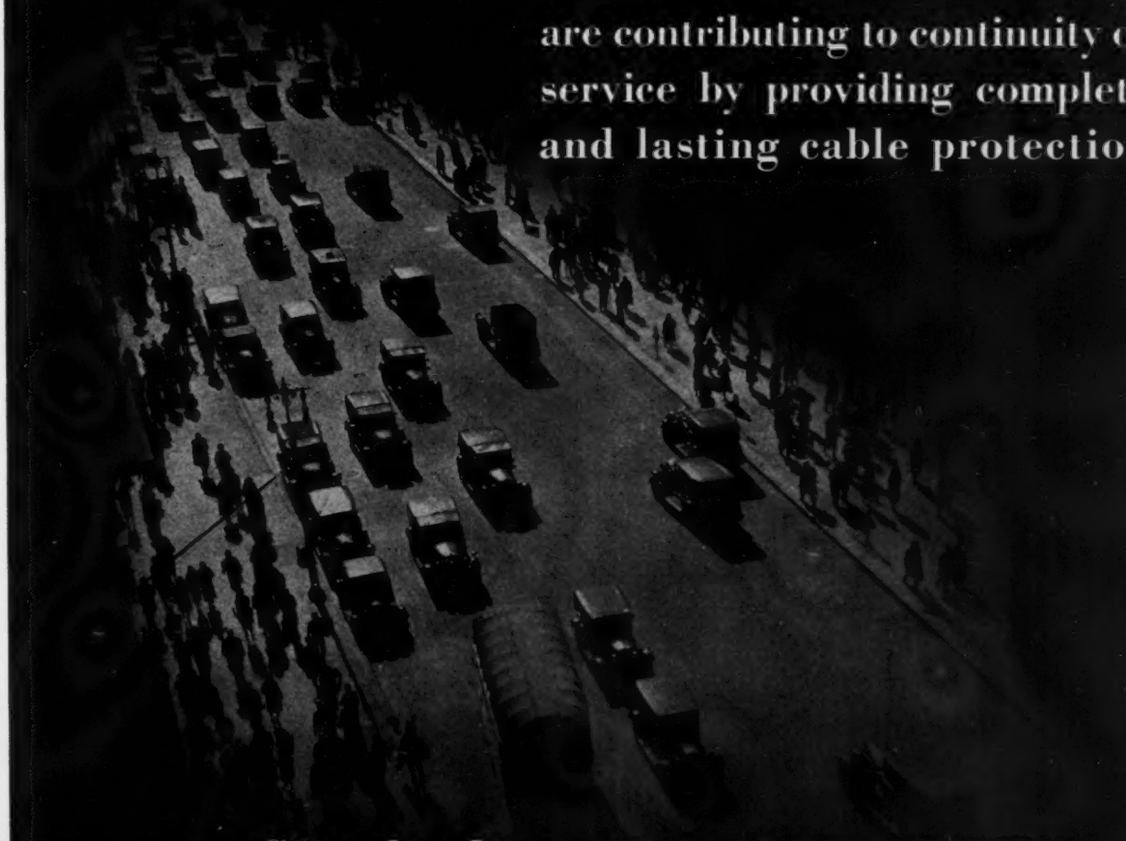
service by providing complete
and lasting cable protection



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*Photograph by Nesmith*

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If you bend conduit and pipe with obsolete bending equipment or clumsy makeshift methods, Greenlee Hydraulic Benders can save you as much as 75% in bending time. Greenlee Benders, with their powerful hydraulic units, bend 3 times faster because they're easier for the man on the job to operate. The No. 770 Bender, shown above, has a maximum pressure of 25 tons for bending 1¼ to 3-inch conduit, while the larger No. 775 Bender with a maximum pressure of 40 tons will handle 3 to 4½-inch material. There's also a complete selection of Greenlee hand benders for tubing up to ¾-inch. Write for new S-116 Bender Booklet . . . it'll show you how to save time and money on every bending job.

★ HERE'S WHY YOU SAVE TIME WITH GREENLEE BENDERS

- ✓ One man can easily and quickly develop the pressure needed to bend conduit up to 4½ inches.
- ✓ You save cost and time of installing many manufactured bends and fittings.
- ✓ You eliminate expense and delay of cutting and threading nipples.
- ✓ The smooth, even bends made by Greenlee, eliminate wasted time when pulling in wire.
- ✓ The Greenlee, built in one unit, is easily carried to the job and set up and is easier for operator to handle.

GREENLEE TOOL CO.
1803 Columbia Ave., Rockford, Illinois

the Baton Rouge Electric Co. in 1931, and five years later he was made head of the El Paso Electric Co., the position he has just left to become president of the Beaumont utility. During the time Mr. Nelson lived in El Paso he was an outstanding civic leader. He was active in the local civilian defense program since it began and his new appointment has left the El Paso Civilian Defense Council without a commander.

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## George L. Knight Retires from New York System

George L. Knight, assistant vice-president of construction and shops of the Consolidated Edison Co. of New York and a vice-president of the Brooklyn Edison Co., has retired after 40 years of service.

In 1902, two years after he was graduated from Drexel Institute, Philadelphia, Mr. Knight started as a

draftsman with the New York Edison Co. and soon was assigned to design work for the completion of the mechanical installation at the Waterside generating station. He later became chief draftsman of the Edison Electric Illuminating Co. of Brooklyn, predecessor of the Brooklyn Edison Co. He was made design engineer in 1905.

He was appointed mechanical engineer in 1923 and nine years later was elected vice-president in charge of mechanical operations. He became vice-president and engineer of construction in 1939. In 1940, when changes were made further to combine the electric and gas operations of the affiliated companies, Mr. Knight became an assistant vice-president of Consolidated Edison for construction and shops. He also continued as a vice-president of Brooklyn Edison. Mr. Knight is a fellow of the American Institute of Electrical Engineers and of the American Society of Mechanical Engineers.

## Dubuque Utility Promotes Four Superintendents

Promotion of four operating superintendents has been announced by the Interstate Power Co., Dubuque, Iowa. Charles Sonnenberg, operating superintendent of the Oelwein district, has been advanced to a similar capacity in the Dubuque district; Leonard Rafferty, operating superintendent of the Bemidji district, will fill the Oelwein operating post; P. J. Brewer, operating superintendent of the Spring Valley district, goes to the Bemidji district in charge of operations, and C. E. Schultheiss, engineering clerk at Lancaster, Wis., has been promoted to operating superintendent of the Spring Valley district.

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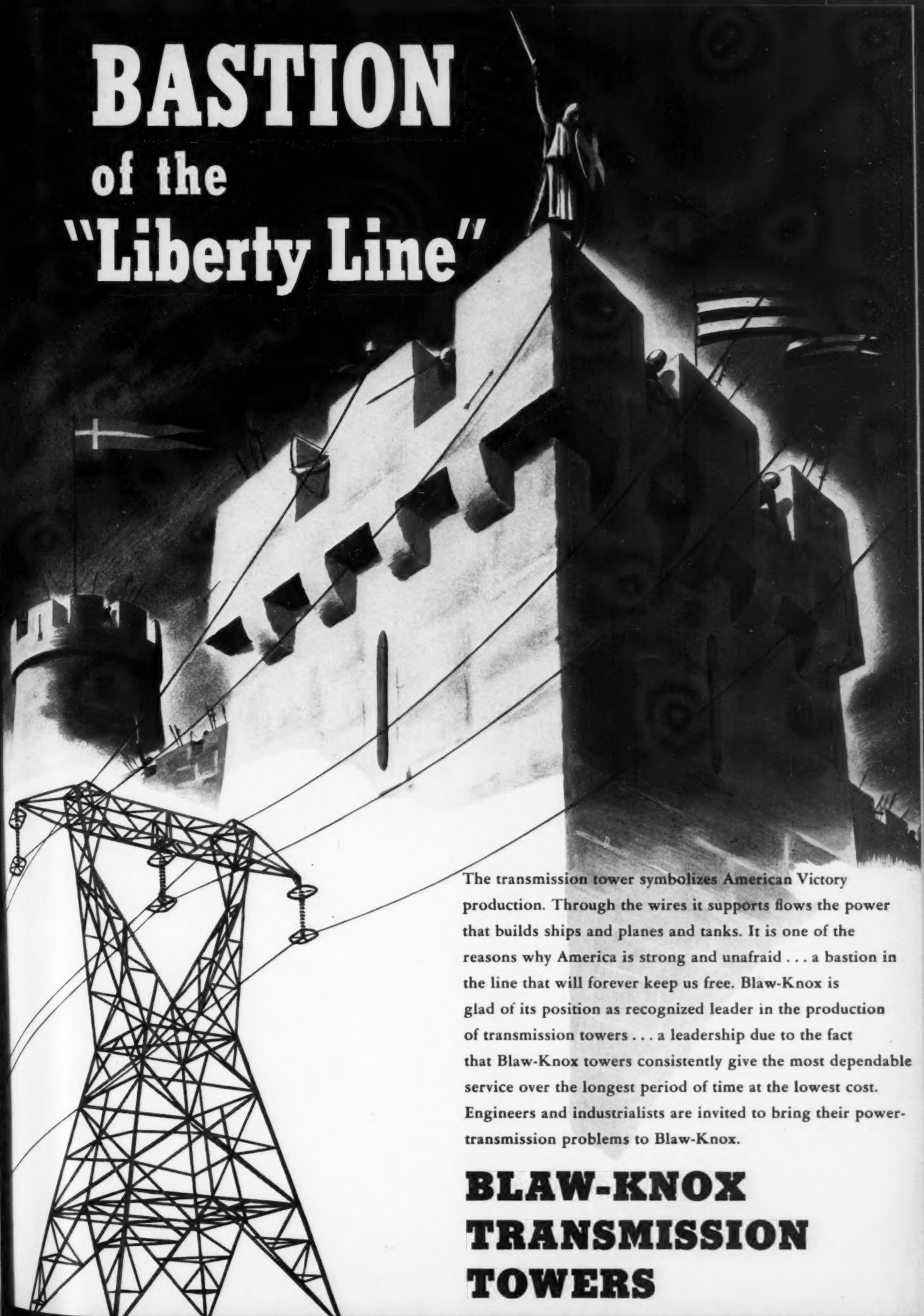
► FREDERICK A. YOUNG, former chief of the state division of public utilities, Providence, R. I., has been appointed state salvage chairman by Gov. J. H. McGrath.

► H. L. RORDEN, formerly development engineer for Ohio Brass Co., is now engineer on high voltage with Bonneville Power Administration.

► WILLIAM H. KLETT has recently been added to the export staff, Marmon-Herrington Co., Indianapolis manufacturers of all wheel drive trucks in direct charge of Latin American business. Mr. Klett, who has had many years experience with Spanish speaking peoples, though a native born American, was educated in Mexico. His automotive experience comprises management of a large distributing firm in Mexico City and many years as district manager in Central and South America for automobile manufacturers.

► F. W. MCCHESNEY and NEAL L. PARKER of the industrial department of the General Electric Co. have been appointed assistant manager, sales, respectively of the industrial manufacturers section and of the machinery manufacturers section. Mr. McChesney joined the wire and cable section of General Electric's central station department in 1918, transferred to the industrial department in 1924 and in 1933 was appointed assistant to the manager of G.E. industrial heating sales. In 1940 he became sales engineer of the industrial manufacturers' section, specializing in the application and sale of electric plant equipment in the printing and publishing industry and in the principal war industries. As an added responsibility, he was recently placed in charge of the application and sales of co-ordinate power-distribution systems for industrial and other war-industry plants. In his new position he

# BASTION of the "Liberty Line"



The transmission tower symbolizes American Victory production. Through the wires it supports flows the power that builds ships and planes and tanks. It is one of the reasons why America is strong and unafraid . . . a bastion in the line that will forever keep us free. Blaw-Knox is glad of its position as recognized leader in the production of transmission towers . . . a leadership due to the fact that Blaw-Knox towers consistently give the most dependable service over the longest period of time at the lowest cost. Engineers and industrialists are invited to bring their power-transmission problems to Blaw-Knox.

## BLAW-KNOX TRANSMISSION TOWERS

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# Connectors

**Save Time**

by using solderless connectors with accurately fitting precision threads which insure easy, permanent installations.

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by using these connectors which are good as new after being salvaged.

**EASY TO INSTALL**

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will continue with this work. Graduating from G.E.'s electrical engineering course in 1923, Mr. Parker joined the industrial sales department at Lynn that same year and was transferred in 1925 to the company's New York office as a salesman in the industrial department. Since 1937 Mr. Parker had been in charge of the manufacturers' section of the industrial department at New York.

J. W. KUSHING of Battle Creek has been appointed chief engineer of the Michigan Public Service Commission to succeed Ray K. Holland, resigned. Mr. Kushing has been in charge recently of the State Highway Department's general engineering research laboratory on the Michigan State College campus.

► GEORGE A. ENGLISH, formerly assistant system operator, Kansas City Power & Light Co., has been appointed superintendent of the system operating department to succeed HARRY MCKINNEY, who recently retired. C. B. MCKNIGHT, relay and instrument foreman of the company, will succeed Mr. English as assistant system operator.

► PHILIP H. PORTER associated with the Wisconsin Public Service Commission for more than 20 years, has resigned as chief counsel. He will reenter private legal practice and will become associated with Claude J. Jasper with offices at 1 West Main Street in Madison. Mr. Porter joined the commission staff in 1919 and in 1930 was appointed commissioner. He resigned in 1931, but returned to the commission as director of transportation in 1933. For the past five years he has been chief counsel and has continued part of his former work in the transportation field.

► ADDISON W. LEE, JR., vice-president in charge of operations of the Louisville Gas & Electric Co., Louisville, Ky., recently celebrated his thirty-fifth year of continuous service with the company. In honor of the occasion T. B. Wilson, president of the company, presented to him a gold service button. Mr. Lee joined the company following his graduation from Rose Polytechnic Institute, Terre Haute, Ind. In addition to his work for the company, Mr. Lee has found time for numerous civic activities and his interest in developing and promoting aviation is widely known.

► D. EDWIN GAMBLE of Chicago, vice-president and general manager of the Borg & Beck division of the Borg-Warner Corp., has joined the staff of the Ordnance Branch, production division of the War Production Board. Mr. Gamble has been associated with Borg-Warner Corp. since 1919, when he was made chief engineer of the Borg & Beck division. He also is chairman of the board of the Pump Engineering Service Corp. and the Borg-Warner Spring Division, other affiliates of Borg-Warner Corp. While working in the production division of WPB he is on leave from these companies.

► A. WELKLIN, municipal electrical inspector, Fort Wayne, Ind., was elected president of the Indiana chapter of the International Association of Electrical Inspectors at the recent annual convention in Indianapolis.

► KENNETH W. PROCTOR, superintendent of the Malden (Mass.) Electric Co., has been named assistant to the manager. He has been succeeded as superintendent by EDWARD H. ADAMS, and L. ALFORD FROST, power sales engineer, has been appointed assistant to the superintendent.

► EDWARD W. HITCHCOCK, distribution engineer for the Athol (Mass.) Gas & Electric Co., has been appointed superintendent of the Middlesex County Electric Co., East Pepperell, Mass., a New England Power Association subsidiary.

► DR. G. FRANK D'ALELIO has been appointed chemist of the General Electric plastics department with headquarters in Pittsfield, Mass. In his new position Dr. D'Alelio is responsible for the direction and supervision of the department's expanding laboratories and research activities. He became associated with General Electric in 1936.

► JOSEPH W. HICKS of Chicago has been appointed director of public relations of the National Confectioners' Association of the United States, Inc., with headquarters in Chicago. For sixteen years Mr. Hicks was a public relations, publicity and advertising executive with the Standard Gas & Electric Co. system.

► GEORGE A. FOWLES has been appointed a sales engineer in the synthetic sales division of the B. F. Goodrich Co., with cable and wire insulation problems as his special field. Following graduation from M.I.T., he started work with the Anaconda Wire & Cable Co. in Pawtucket, R. I. He developed various rubber insulating compounds for special types of cables, a special die for extruding heavy wall thicknesses of insulating materials and obtained a patent on the vulcanization of rubber-insulated wire by high-frequency radio waves. After leaving Anaconda he served as an engineer with Jackson & Moreland in appraisals of various utility systems and was instrumental in developing a new system of depreciation which is widely used.

# Model trains changed into Naval instruments

## *...through cooperation between Lionel and Revere*

It's hard to say who gets the more enjoyment out of Lionel electric trains and accessories . . . a boy or his father. But it is certain that both are experts in appraising the accuracy and *realness* of scale models. So the Lionel Corporation has had long experience in precision manufacturing for this ultra-critical market. And that proved the best of preparation when Lionel got into the production of Naval instruments in addition to model trains.

But any departure as great as this is sure to create problems. Not only did new equipment have to be selected, but the brass to be used was of a different analysis requiring entirely new methods.

Here is where a Revere Technical Advisor was able to perform an essential service. Revere's exceptional knowledge of brass, of fabricating processes and methods, aided Lionel greatly in setting up all the new operations and fitting them smoothly into volume production.

In this way Lionel has quickly taken an important place in America's war effort . . . and Revere once again has been able to contribute both the metals and the specialized knowledge of copper alloys which have sped so many such projects forward to success. Through the Revere Technical Advisory staff this same service is available to you. Why not get in touch with Revere now?

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## OBITUARY

▶ WILLIAM M. REID, superintendent of the Canton (Miss.) municipal utilities for 19 years, died on February 16 after an illness of several months. Mr. Reid was 46 years old.

▶ CAMERON DE WITT JARVIS, 71, a retired engineer of the New England Telephone & Telegraph Co., Boston, who was a pioneer in equipment development and who was for some time identified with the foreign wire relations work of that organization in connection with central stations and other utilities, died at Miami, Fla., March 6.

▶ DR. ROBERT BOSCH, German industrialist and manufacturer of the magneto bearing his name, died at Stuttgart on March 12 after an illness of a few days. He was 81 years old. Dr. Bosch received his early technical training in this country when he visited here at the age of 23. He worked with Dr. Sigmund Bergmann and Thomas A. Edison and then went to England, where he was employed at the Siemens works at Woolwich. At the age of 25 he opened his own workshop in Stuttgart, where he made house telephone appliances. Later he started manufacturing spark plugs. In 1901 he developed the Bosch magneto and Bosch lamp.

▶ SIR WILLIAM H. BRAGG, well known physicist, died in London, England, on March 12 at the age of 79. Though Sir William won frequent recognition for his studies in atomic and molecular structures, he was probably best known for his work in popularizing science. During his visit to this country in 1930, he was the guest of honor at a luncheon at the Hotel Astor in New York attended by 200 scientists. That year he also received the Franklin gold medal of the Franklin Institute. In 1936 the Institution of Electrical Engineers of Great Britain awarded the Faraday Medal to him. He was a past-president of the British Association for the Advancement of Science.

▶ FAY C. HAMILTON, for 25 years consulting engineer for Cities Service Co. of New York, died on March 7 at the age of 55. He was consulting engineer for Electric Advisers, Inc., an advisory company on rates and valuation for Cities Service. Mr. Hamilton, who was a member of the executive committee of Henry L. Doherty & Co. and of Cities Service Co., had been absent from business since February 1. Mr. Hamilton joined the Doherty company in 1917, and while with that organization appeared before public utility commissions in 22 states.

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**The aircraft industry is seeking additional hundreds of subcontractors to speed the world's largest wartime airplane program**

With so many manufacturers from other fields signing up for the production battle, there is an urgent need for a *quick way* to bring together the prime contractor and your organization — to help him accelerate production.

To secure favorable consideration, you must do a selling job aimed at the prime contractors. Instead of waiting for them to make the first move, command their attention by advertising your plant facilities and equipment in *Aviation Magazine's* new SUBCONTRACTORS SECTION.

This new service to Subcontractors provides an economical, effective and faster means of establishing and maintaining contact between you — the seller, and the prime contractors — who are the buyers — to speed the process of selecting specific service and equipment.

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. . . to assure continuity of work during the emergency

. . . to make certain that the thousands of aircraft executives and experts in charge of production know about your plant, equipment and experience in related work

. . . to present your production story to the hard-to-reach men whose business is wartime output

. . . to maintain your contacts and position in America's No. 1 industry

**You can speed your offer of help to the key men of American aviation quickest through the advertising pages of the special SUBCONTRACTORS SECTION in Aviation . . . the industry's No. 1 business magazine.**

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Yes, we are interested in getting Aviation Subcontract Work. Without obligation, please send us the new folder telling "How AVIATION helps Spread-the-Work . . . by bringing together Prime Contractors and Subcontractors." EW

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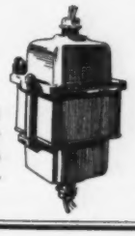
Above — AmerTran power transformers available for all requirements in sizes to 10,000 KVA., 132 KV.

Left — AmerTran distribution transformers of either oil or non-inflammable-liquid immersed type available in sizes to 500 KVA., 72 KV.



Right — AmerTran air-cooled transformers for either indoor or outdoor service are available for all industrial requirements—sizes to 150 KVA.

WEEKS before its wheels leave the runway, every detail of the modern Bomber has been engineered to meet exact specifications, for the service it is to render. So, too, you can have TRANSFORMERS engineered, mechanically and electrically, to your specifications and your particular service requirements. To the production of transformers AmerTran brings wide experience, complete facilities and a 40-year record of satisfactory service rendered in utility companies and industrial plants the country over. AmerTran transformers are available for every industrial, laboratory and electronic requirement in both large and small quantities, and in sizes up to 10,000 KVA., 132 KV. Let us quote on equipment for your needs.

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***Manufactured Since 1901 at Newark, N. J.***

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Acme Wire Products

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# REA Allotments Total $3,560,500

REA Administrator Harry Slattery recently announced allotments of $3,560,500, bringing the total to $443,416,244, of which $74,718,200 represents operations during the current fiscal year.

Eight cooperatives in northern Ohio will receive a total of $3,036,000, of which $1,100,000 will be expended immediately to finance the purchase of the properties of the General Utilities Company, Western Reserve Power and Light Company and the New London Power Company. These are all Associated subsidiaries. Their distribution lines extend into the twelve counties of Allen, Ashland, Hancock, Henry, Huron, Lorain, Medina, Putnam, Seneca, VanWert, Wayne and Wood and presently serve almost 7,000 rural consumers who will continue to receive power.

In conformity with the recent announcement that there would be no new line construction except in accordance with authorization or regulations of the War Production Board and that in the case of allotments involving acquisition of existing properties the funds allotted for new construction would not be used until the war is over, construction covered by these allotments will not be started at this time.

Details of the Ohio allotments are:

Holmes Rural Electric Cooperative, Inc., Millersburg, Geo. Hefferline, supt., $269,000 to build and acquire 209.55 miles of line, 888 members.

Midwest Electric, Inc., St. Mary's, Thos. R. Kern, supt., $329,000 to build and acquire 372 miles of line, 1,156 members.

Paulding-Putnam Electric Cooperative, Inc., Paulding, Herbert K. Monroe, mgr., $538,000 to build and acquire 551.5 miles of line, 1,792 members.

Lorain-Medina Rural Electric Cooperative, Inc., Wellington, Harry Bovard, supt., $671,000 to build and acquire 166.7 miles of line, 2,172 members.

North-Central Electric Cooperative, Inc., Attica, R. J. Williams, supt., $96,000 to build and acquire 103 miles of line, 294 members.

Tri-County Rural Electric Cooperative, Inc., Napoleon, A. E. Steinbrecher, mgr., $261,000 to build and acquire 220 miles of line, 936 members.

Firelands Electric Cooperative, Inc., North Fairfield, M. J. Wilhelm, supt., $308,000 to build and acquire 138 miles of line, 1,020 members.

Hancock-Wood Electric Cooperative, Inc., North Baltimore, R. P. Luse, supt., $564,000 to build and acquire 527.64 miles of line, 1,808 members.

Other allotments include the following:

Alabama—Wiregrass Electric Cooperative, Inc., Hartford, Howard Haygood, supt., $35,000 to complete a section of the system.

Colorado—Intermountain Rural Electric Assn., Littleton, Charlie See, mgr., $50,000


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distribution line in El Paso and Teller counties and to build 27.15 miles of line to serve 229 members. Gunnison County Electric Assn., Inc., Crested Butte, V. A. Morgan, $10,000 to complete a section of the system.

Georgia—Walton Electric Membership Corp., Monroe, John L. Snow, mgr., $50,000 to complete a section of the system.

Indiana—LaGrange County REMC, LaGrange, Arthur L. Cain, mgr., $25,500 to complete a section of the system. Jackson County REMC, Brownstown, Edward E. Combs, Jr., $35,000 to complete a section of the system.

Iowa—Clarke Electric Coop., Inc., Osceola, A. F. Klein, pres., $17,000 to complete a section of the system.

Louisiana—Teche Electric Membership Corp., Centerville, John Chaney, mgr., $5,000 to compete a section of the system.

Michigan—O and A Electric Cooperative, Newaygo, Notley J. Butler, mgr., $50,000 to complete a section of the system. Cloverland Electric Cooperative, Sault Sainte Marie, Harvey E. Kappahahn, mgr., $60,000 to complete a section of system.

Minnesota—North Star Electric Cooperative, Inc., Baudette, $12,000 to complete a section of the system.

Montana — Mid-Yellowstone Electric Coop., Inc., Hysham, John Grierson, supt., $3,000 to provide office headquarters.

Nebraska—Polk County Rural Public Power District, Stromsburg, Gustaf E. Ekstrand, supt., $29,000 to complete a section of the system. Burt County Rural Public Power District, Takamah, E. D. Beck, supt., $7,000 to provide office headquarters.

Tennessee—Volunteer Electric Cooperative, Decatur, W. S. Bates, mgr., $30,000 to provide office headquarters. Upper Cumberland Electric Membership Corp., Carthage, W. E. Landers, supt., $40,000 to complete a section of the system.

Texas—New Era Electric Cooperative, Inc., Athens, $14,000 for installation loans to be made to the cooperative members.

Vermont—Vermont Electric Cooperative, Eden Mills, Harry D. Bowman, supt., $35,000 to complete a section of the system.

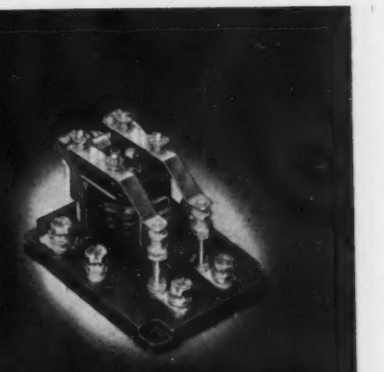
Wisconsin—Oakdale Cooperative Electrical Assn., Oakdale, Lloyd McCaskey, supt., $17,000 to provide office headquarters and storeroom facilities.

•

## Puts Conservation Plan on Tires into Effect

A thoroughgoing program for conservation of automobile tires has gone into effect throughout the Georgia Power Co. to meet the situation caused by the rationing plan, under which only 9 percent of the normal supply was available to the public in January for all needs.

Vice-President and General Manager W. E. Mitchell promptly issued a recommendation that all divisions and the general office of the company reduce mileage of passenger cars by 25 percent and trucks by 15 percent. The division managers responded with orders that company auto mileage in their territories be slashed by various amounts, up to as much as 50 percent. Randolph Whitfield, supervisor of automotive equipment, has sent all garage superintendents suggestions for care of tires.

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# Sales Opportunities

MADISON, WIS.—Wisconsin Power & Light Co., Madison, plans improvements in steam department at steam-electric generating station at Berlin, Wis., including installation of stokers for two new boiler units and auxiliary equipment. Company also will make extensions and improvements in primary and secondary lines in Janesville, Wis., district, including power substation facilities. Last noted work is reported to cost in excess of $100,000. New power substation at Portage, Wis., will be designed for large capacity and will be built in conjunction with extensive additions in transmission and distributing lines in that area, with entire project reported to cost close to $500,000.

PHILADELPHIA, PA.—Department of Public Works, Bureau of Water, City Hall Annex, receives bids until April 8 for electric switchgear, control switchboard and power transformers for Torresdale pumping station for municipal water system, including such equipment for nine pumping units with rated capacity of 212,000,000 gal. per day. Specifications at office of Bureau, Room 241, Chestnut Street pier (Contract 114-WWI).

BENWOOD, W. VA.—Wheeling Steel Corp., Wheeling, W. Va., plans installation of heavy-duty motors and controls, transformers and accessories, switchgear, motor-generator sets, industrial lighting equipment, electric conduits, power wiring, electric hoists, electric cranes, conveyors and other equipment in connection with expansion at steel mills at Benwood, and Steubenville, Ohio. Work will include several large mill units and other structures, with output to be used by government. Entire project will cost about $18,000,000, with financing to be arranged through Defense Plant Corporation, Washington, D. C. Work is scheduled to begin soon.

WATERTOWN, S. D.—City Council has authorized plans for extensions and improvements in steam department at municipal power station, including installation of new boiler unit and accessory equipment, coal storage and handling facilities, etc. Estimates of cost will be made soon. Ralph D. Thomas & Associates, 1200 Second Avenue South, Minneapolis, Minn., are consulting engineers.

SARASOTA, FLA.—District Engineer, United States Engineer Office, Jacksonville, Fla., receives bids (no closing date stated) for installation of airport lighting system at Sarasota-Manatee County Airport, Sarasota, including boundary and range lighting circuit, contact lighting system, airport beacon and tower, wind tee, transformer vault, obstruction light system and control panel, as per plans and specifications on file.

MEREDOSIA, ILL.—Central Illinois Public Service Co., Springfield, Ill., is asking bids until April 2 for general erection of proposed new steam-electric power plant at Meredosia, consisting of a multi-story structure, 150x200 ft., with 130-ft. steel stack. It will be equipped for large capacity. No estimate of cost announced. Sargent & Lundy, Inc., 140 South Dearborn Street, Chicago, Ill., is consulting engineer.

AKRON, OHIO—Goodyear Tire & Rubber Co., Akron, plans installation of motors and controls, transformers and accessories, switchgear, electric conduits, power wiring, industrial lighting system and other equipment in one and two-story addition to synthetic rubber mill, about 100x200 ft., for production for government. Cost reported close to $1,200,000, including machinery. Work will be placed under way soon. Financing will be provided by Defense Plant Corporation, Washington, D. C., a Federal agency. J. Gordon Turnbull, Citizens' Building, Cleveland, Ohio, is consulting engineer.

BELLAIRE, OHIO—Ohio River Power, Inc., Alliance, Ohio, recently organized as an affiliate of Ohio Public Service Co., Cleveland, Ohio, has secured permission from State Public Utilities Commission to issue stock in gross amount of $500,000, to be purchased by parent company. Of the proceeds, $379,840 will be used by new organization for acquisition of power site at Dilles Bottom on Ohio River, vicinity of Bellaire, held by parent company for a number of years. Plans are maturing for construction of new steam-electric generating plant at that place, which, following completion, will be operated by Ohio Public Service Co., under lease. It will be equipped for an initial capacity of 50,000 kw. Project will include a new transmission for generating plant to Alliance, where connection will be made with large power substation for switching service, as well as local distribution. Entire development is estimated to cost about $8,000,000.

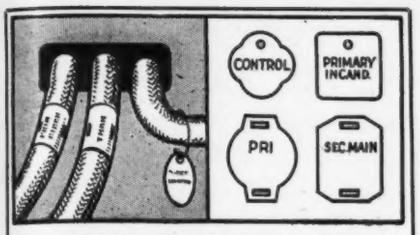
BESSEMER, MICH.—City Council has called a special election on April 6 to approve bond issue of $90,000, fund to be used for purchase of a new generating unit for city-owned power station, making third such generator at plant. Plans are being prepared for the expansion.

BALTIMORE, MD.—Standard Oil Co. of New Jersey, 26 Broadway, New York, N. Y., plans installation of motors and controls, switchgear, transformers and accessories, industrial lighting facilities, electric conduits, power wiring and other equipment in new addition to branch oil refining plant at Boston and Dean Streets, Baltimore, to be used as an alkylation unit. Cost estimated close to $750,000. Proposed to carry out work soon.

•

## Utility Submetering Case Dropped by State Board

Pennsylvania Public Utility Commission has announced termination of the proceedings instituted by it for the purpose of determining the propriety of submetering and remetering electric energy as permitted by the Philadelphia Electric Co. The board found that aside from practical considerations and technical objections to jurisdiction and procedure, its decision not to require prohibition of remetering or resale turns upon its conclusion that the record in the case does not show such a requirement to be necessary at this time for public protection.

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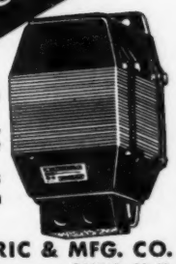

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# LETTER TO THE EDITOR

## Overloads and Transformer Life

*To the Editor of* ELECTRICAL WORLD:

In the report of the A.I.E.E. convention, which was published in the February 7 number of the ELECTRICAL WORLD, I was quoted as stating that "efforts to estimate the effects of overloads on transformer life were entirely futile, since it is impossible to estimate such life in any instance."

I certainly hope that those attending the convention did not get any such impression from my remarks, because I certainly had no intention of making any such statement. The statement I did make was to the effect that "the data which have been presented can be very helpful as a guide for determining how far to go in loading transformers, but it should be kept in mind that the life of an individual transformer is not subject to exact determination." I certainly did not say that "efforts to estimate the life of transformers were entirely futile."

My point was that while the data presented are very helpful as a guide, they should not be considered as a precise method of determining the life of any individual transformer.

R. T. HENRY,
Assistant Chief Electrical Engineer
Buffalo Niagara Electric Corporation
Buffalo, N. Y.

•

## Inland Co-operative Starts Power Delivery

Inland Empire Rural Electrification, Inc., has started distributing Columbia River power to more than 1,400 customers in Whitman and Garfield counties, Bonneville Power Administration officials have announced. The co-operative takes delivery of power at the Bonneville Administration's Colfax substation. A transmission line carrying Columbia River power from Lewiston, Idaho, to Colfax was energized recently.

In addition to its contract for 800 kw. for distribution over its southern system, the co-operative already has entered into negotiations with the Bonneville Administration for additional federal power to supply customers on its northern system. The co-operative operates a 1,500-mile system in Spokane, Whitman and Garfield counties and the extreme southern portion of Stevens County. It supplies energy to a total of more than 3,000 customers.


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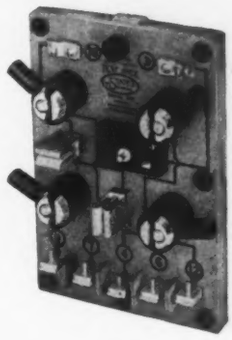

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See Supplement to Cat. #1, Sec. 8, Sheet #108C1.

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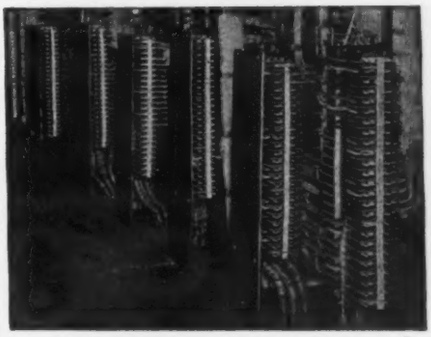

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## M.K.B. Modifies Its Promotional Program

The national advertising program on electric ranges sponsored by the Modern Kitchen Bureau has been canceled owing to exigencies of war and the probability of increased supply difficulties, it was announced by C. J. Coward, chairman of the bureau's range advertising committee and advertising manager, Kelvinator division, Nash-Kelvinator Corp.

Educational work on the electric range, as an efficient method of protecting natural food elements during the cooking process, and as a time- and labor-saver for American housewives in the emergency period, will be continued through the bureau's over-all operations. "It Happened in the Kitchen," the bureau's full color talking motion picture, and several mailings of packages of ideas for complete advertising campaigns stressing the "Gain Through Use" advantages of the electric kitchen and its appliances, designed for use by utilities, will help to keep the idea of electric cooking alive in the public mind.

The electric kitchen and electric water heater programs of the bureau will continue as originally planned, according to W. A. Grove, chairman of the bureau's plan committee and advertising manager, Edison General Electric Appliance Co.

•

## Transmission Line Proposed for Denver

Expenditure of $1,919,000 for additions to its electric system is planned in 1942 by the Public Service Co. of Colorado at Denver, according to Guy W. Faller, president.

Accounting for a major portion of the 1942 expenditure will be completion of construction begun during 1941, when the company carried on one of its most intensive construction schedules in recent years.

A total of $3,666,000 was spent for additions and improvements to electric facilities last year.

Construction of a new 44-mile, 110-kv. transmission line and terminal substation connecting the Valmont plant with North substation in Denver and Greeley substation is under consideration by the company for 1942, provided materials are available.

Additional generating capacity equal to 20 percent of the company's central system peak load was installed at the Valmont plant last year and no further additions are anticipated in 1942.


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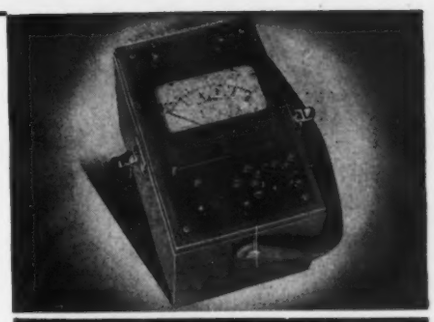

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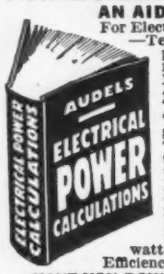


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### OFFICIAL PROPOSALS

Bids: April 2 (85)

***Installing Signal and Interlocking Equipment***

CITY OF CHICAGO STATE STREET SUBWAY
CONTRACT T-8

Sealed bids, endorsed "PROPOSAL FOR INSTALLING SIGNALS AND INTERLOCKING EQUIPMENT, CONTRACT T-8," will be received by the City of Chicago, in the County of Cook and State of Illinois, at the office of the Commissioner of Subways and Superhighways, Room 1940, 20 N. Wacker Drive, Chicago, Illinois, until 2 o'clock P.M., Central Standard Time (United States War Time), on Thursday, April 2nd, 1942, at which place and time all such proposals will be opened publicly and read aloud by a representative of the Commissioner of Subways and Superhighways.

The work for which such proposals are invited consists of installing an electro-pneumatically operated automatic block signal system complete with wayside signals, automatic train stops, interlocking equipment and controls, and other materials and equipment appurtenant and collateral thereto. The signal system is to be installed in and on the structures of the State Street Subway located in S. State Street, N. State Street, W. Division Street, N. Clybourn Avenue and in rights-of-way which have been or will be acquired by the City of Chicago, and on the elevated track structure of the Chicago Rapid Transit Company located adjacent to the two points of connection of said subway with said elevated track structure, as shown on the plans and described in more detail in Requirements for Bidding and Instructions to Bidders.

All bids must be made upon blank forms of proposal as furnished by the Commissioner of Subways and Superhighways and included in the Contract Documents, and shall be made in accordance with the provisions contained in said documents.

The Contract Documents, including Standord Specifications for Subway Construction, Contract Requirements and Contract Plans, are on file and available to bidders at the office of the Commissioner of Subways and Superhighways at Room 1940, 20 N. Wacker Drive, Chicago, Illinois. Copies of the Contract Documents may be obtained by depositing Twenty-five Dollars ($25.00) with the Commissioner of Subways and Superhighways, for each set of documents. The amount of the deposit for one set of documents will be refunded to each actual bidder who returns the said documents in good condition within ten (10) calendar days after the opening of bids. Fifteen Dollars ($15.00) will be refunded for each of all other sets of documents so returned.

Each proposal must be accompanied by cash or a certified check drawn on some responsible bank doing business in the city of Chicago, in the amount of Twenty Thousand Dollars ($20,000.00) payable to the order of the City of Chicago. Any proposal submitted without being accompanied by such cash or certified check may be considered informal and consequently may be rejected.

The City of Chicago reserves the right to reject any or all bids and to disregard any informalities in the bids and bidding.

No bid may be withdrawn, after the scheduled closing time for receipt of bids, for at least forty-five (45) calendar days.

CITY OF CHICAGO,
By PHILIP HARRINGTON,
Commissioner of Subways and Superhighways.

Chicago, Illinois, March 12, 1942.

### OFFICIAL PROPOSALS


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